OFR 89-003

OPEN FILE REPORT ON SELECTED METALLIC MINERAL OCCURRENCES OF THE ANTIGONISH AREA

NTS 11E/08, 09 and 16

BY K. E. NORTHCOTE, G. DEMONT AND A. ARMITAGE

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NTS 11/E 08, 09, and 16

by: K. E. Northcote, G. DeMont and A. Armitage

NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY

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NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY MINERAL OCCURRENCE DATABASE

During compilation of mineral occurrence data for the Metallotectonic project it was found that information in the Nova Scotia Metallic Mineral Occurrence Database (MOD) could not be used. Field checks of mineral occurrences showed that a significant percentage of the MOD files contained erroneous and misleading information.

Emphasis was therefore changed from examining a few occurrences in detail to attempting to locate, sample, and describe as many mineral occurrences as possible before termination of the Canada-Nova Scotia Mineral Development Agreement, March 31, 1989. These newly generated data are compiled as Open File Reports for use in the Metallotectonic Project and as a start in upgrading and correcting the existing MOD.

A fundamental requirement of the metallic mineral exploration industry and agencies conducting geological research in Nova Scotia, (including NSDME staff geologists), is a comprehensive, up to date, reliable metallic mineral occurrence database. MOD must be completely redone starting with thorough literature research, as G. DeMont is presently doing, followed by meticulous field examinations. As recommended by DeMont, the MOD should be expanded to include mineralized drill core intersections, particularly those which do not crop out at the surface. This information would perhaps double (if not triple) the number of MOD occurrences. Because workings become inaccessible through time a catalogued rock, mineral and analytical pulp library is an integral part of a MOD in conjunction with the core library at Stellarton.

Nova Scotia, as compared to other provinces, such as B.C., is in an excellent position to upgrade and compile a MOD. There are about 800 indicated occurrences, approximately 600 of which require immediate field checks; a realistic number to examine in a few field seasons at low cost. A relatively small area is involved and most of the occurrences are readily accessible, so helicopter costs are negligible. There are numerous occurrences for which excellent quality data are available in the files and minds of government Resource and Development geologists. Unfortunately some of these data, with notable exceptions, will be lost as geologists leave the department because addition of these data to MOD was not made one of their responsibilities.

Information gathered in the field includes: location, surface dimensions, visible development, type of deposit, commodity, mineralogy, alteration, geologic description, and geologic map (if required), geologic (tectonic) environment, age, and a statement of possible significance of the occurrence. An important part of the examination is sampling for petrographic and chemical analyses of mineralization, gangue, alteration, and wallrock. Chemical analyses should be made for as large a variety of elements as possible because of the wide range of interest of potential users. Our interest here is primarily in detecting anomalous concentrations of metals but analyses should include elements of interest to researchers other than industry. All these data can be distributed as hard copy and, with the exception of maps and figures, are amenable to a computer database for distribution on diskette.

The program is one which requires continuity. A piece-meal, incomplete, unreliable inventory will again result from anything less than full commitment of funding and competent staff with a knowledge of, and a background working with, mineral occurrences. If done properly, the resulting database will provide a complete and reliable source of information pertaining to all the mineral occurrences of Nova Scotia. If the database is maintained continuously it can only stimulate exploration for decades into the future. It would also make obvious new and potentially valuable avenues of geologic research and aid in their interpretation.

ACKNOWLEDGMENTS:

I wish to acknowledge the valuable assistance of numerous colleagues. I wish to thank A. Sangster of the G.S.C. for discussion, liberal use of his data, and for the time he spent with me visiting mineral occurrences in the field. I also wish to thank W. Ervine, who was carrying out a similar project to mine for the G.S.C., for use of his data which helped avoid unnecessary duplication of effort. Brendan Murphy allowed advance use of his geologic maps of the Antigonish area, brought a number of new mineral occurrences to my attention and spent several days examining them with me in the field. Sandra Barr and Alan Macdonald also provided me with valuable geologic information and advice.

A number of exploration geologists and prospectors provided excellent information and showed me a number of significant occurrences. In particular I wish to acknowledge the assistance of Alex Thomson and Budd McKenzie. I also greatly appreciate the assistance of the many residents who lead me to obscure occurrences and gave permission to trespass on their property.

I thank all my colleagues at NSDME but particularly J. D. Keppie, A. Chatterjee, J. M. Patterson, G. O'Reilly, and D. Kontak for their time in the field and helpful discussion. A very special thank you to G. DeMont who coordinated his library research with my needs in the field, for bringing to my attention a number of significant occurrences and for accompanying me in the field to examine them. Finally, a sincere thank you to my field partner, Allan Armitage, for an excellent 1988 field season.

MOOSE RIVER - GARDEN OF EDEN E08-01

OCCURRENCE: MOOSE RIVER - GARDEN OF EDEN E08-01 (Copper-zinc)
MILL STREAM PROSPECT

LOCATION: 5032410 N 552430 E NTS 11E/08C

ACCESS:

On Highway #347, drive to Mill Brook 1.5 km northwesterly from bridge crossing Moose River just northwest of Garden of Eden. Walk 100 m west along the south side of Mill Brook to excavated carbonate vein system on the south bank of the brook.

REFERENCES:

Bourque, D., 1982. Metallogenesis and mineral deposits of Antigonish Highlands - a detailed summary of field investigations. Unpublished M.Sc. Thesis, Dalhousie University, NSDME Open File Report 383.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highlands, Sheets 1 and 2, Scale 1: 50 000. GSC Open File Report 1181.

Murphy, J. B., Keppie, J. D. and Hynes, A. J. (In press). Geology of the Antigonish Highlands. G.S.C. Memoir.

NSDME AR 11E/08C 13-M-10 (1), Copper, Garden of Eden, Pictou County.

TECTONIC ENVIRONMENT:

The section on tectonic environment is taken from Murphy et al., in press. The Bears Brook Formation, lowermost Silurian, is part of the lower Arisaig Group which shows significant lithological variations across the fault blocks comprising the Antigonish Highlands. North of the Browns Mountain Fault redbeds predominate and the volcanic rocks are relatively minor. South of this fault, in the western highlands, the redbeds are interlayered with mafic and felsic volcanics. In the southern highlands, in the vicinity of Moose River, felsic volcanic rocks predominate over mafic flows and redbeds and are estimated to be at least 400 m thick. Here the Bears Brook Formation consists largely of subaerial felsic pyroclastic volcanics, argillaceous tuff and lesser argillite. The tectonic setting of the Bears Brook Formation is probably a within plate continental rift.

STRUCTURE:

The section on structure is taken from Murphy et al., in press. The rocks in the Moose River - Garden of Eden area are moderately deformed except adjacent to faults where there may be intense deformation. Faults are of varied age and may have undergone repeated motion. The Chedabucto Fault has probably been repeatedly active since the late Precambrian with repeated strike-slip and dip-slip motions during the Paleozoic. The probable age of major displacement may be roughly synchronous with age of docking of the Meguma Terrane. The northerly trending Moose River Fault appears to be truncated by the Chedabucto and Browns Mountain Faults and suggests that the Moose River Fault is probably of middle or late Devonian age.

GEOLOGIC DESCRIPTION:

The surface exposure of the occurrence consists of a near vertical carbonate vein system filling a fissure zone 2.5 m wide exposed at the east end of a 4 m high excavation. Most of the geologic information, however, is from drillhole data.

The mineralization is in Bears Brook Formation, O_{BV}, of Ordovician - Silurian age, consisting of rhyolite, rhyolitic tuff and minor basalt (Murphy, 1986). Discontinuous carbonate - ankerite and lesser quartz veins occur in brecciated zones in interbedded argillite, tuffaceous argillite, rhyolite breccia, tuff and agglomerate. Narrow dykes(?) of altered granite(?) are reported in drillholes (NSDME AR).

The brecciation and carbonate infilling, as well as hydrothermal alteration and mineralization, are related to structural rather than depositional events (Moose River Fault) and would therefore probably be middle or late Devonian in age.

MINERALIZATION:

Drill Core: data from NSDME AR.

Some disseminated chalcopyrite and pyrite occurs in carbonate veins and lesser amounts are disseminated along bedding planes and schistosity.

The locations of drillholes, MR-1, MR-2, and MR-3, relative to the occurrence are indicated on Figure 2.

TABLE 1

ASSAYS FROM DRILLHOLES
Atlantic Resource Consultants (C. MacLeod)

Drillhole	Interval	% Zn	% Cu
MR-1	67.0 - 70.0	Tr	0.22
	70.0 - 73.0	Tr	0.03
	73.0 - 78.0	0.05	0.07
MR-2	36.5 - 40.6	0.05	1.20 (1.15)
	40.6 - 45.6	0.15	0.03
	45.6 - 50.6	0.25	0.18
	50.6 - 55.6	0.25	0.13
	55.6 - 60.6	0.20	0.23
MR-3	236.6 - 241.0	0.07	0.16
	241.0 - 246.0	0.05	0.09
	246.0 - 251.0	0.07	0.18
	251.0 - 256.0	Tr	0.03
	256.0 - 261.0	0.05	0.44

Surface Showing: data from Northcote field check 1987; Northcote and DeMont field check 1988; and Bourque, 1982, p. 256.

The surface showing is an excavation on the south bank of Mill Brook approximately 100 m west of the highway. The showing consists of irregular discontinuous brecciated, shattered carbonate veins with the main zone 2.5 m wide with shearing extending to about 6 m. Fragments of country rock are incorporated in the veins.

Approximate attitude 140°/55° NE
150°/65° NE

Country rock is argillite, tuffaceous argillite, rhyolite breccia which contains weathered-out iron-stained pits. There are some open spaced siliceous fracture fillings. Rhyolite breccia contains pyrite and pyrrhotite disseminations.

TABLE 3

SAMPLES

87 MRGE 2021 chip sample across 2.5 m carbonate vein.
87 MRGE 2023 brecciated, iron-stained tuff.
88 MR 8701 selected sample, mineralized, carbonate vein.
88 MR 8702 volcanic breccia

RESULTS:

Soil geochemistry shows no striking anomalies (NSDME AR 11E/08C 13-M-10 (01)).

Diamond-drill holes show subeconomic copper over short intervals. The best mineralization is in carbonate veins and breccia infilling giving values of 0.19% Zn and 0.32% Cu with unproven continuity over 24.1 ft in drillhole MR-2 (NSDME AR 11E/08C 13-M-10 (01)).

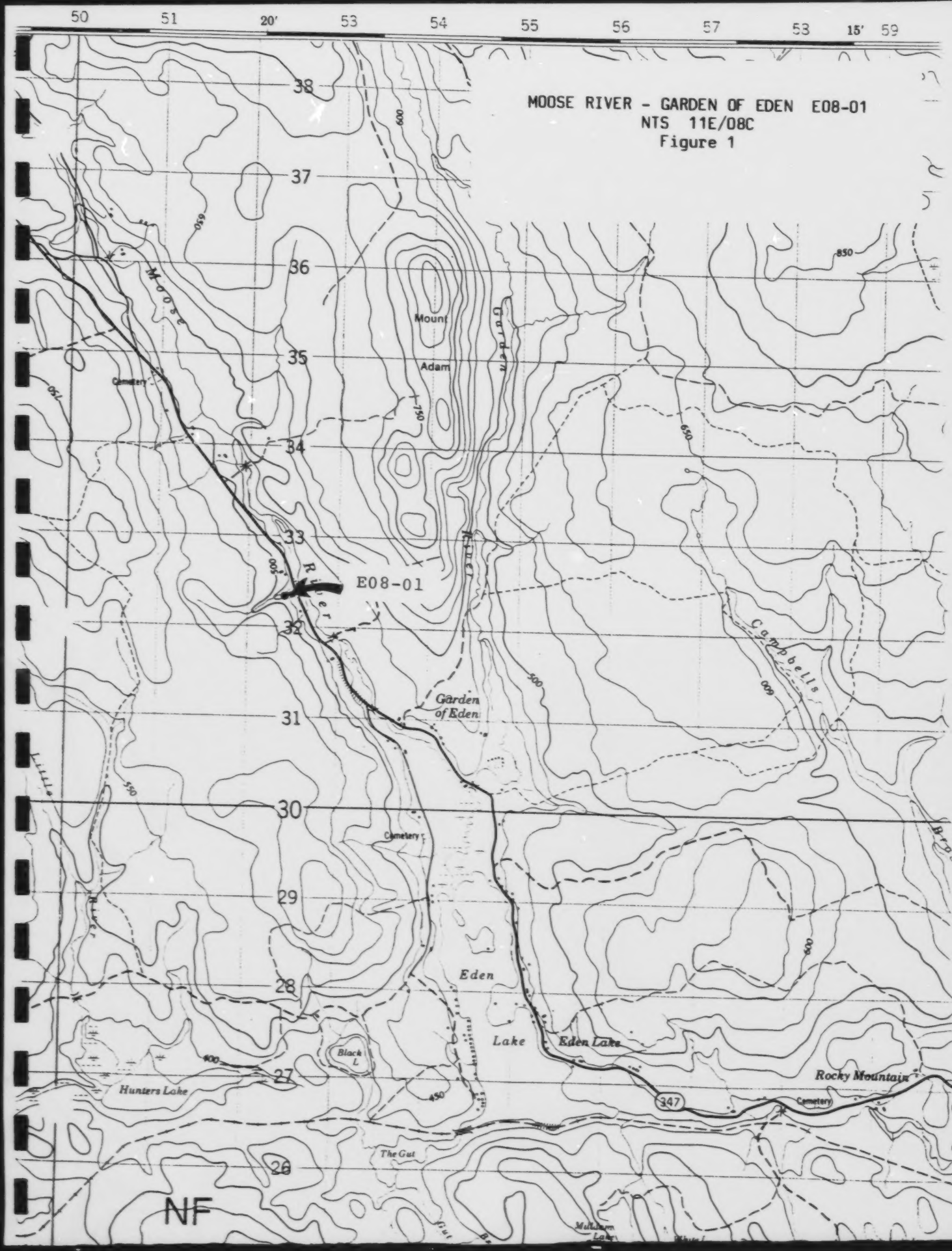
Chip samples across 2.5 m of the surface vein gave copper values of 2350 ppm. Gold analyses of vein and country rock gave threshold values of 14 and 24 ppb respectively.

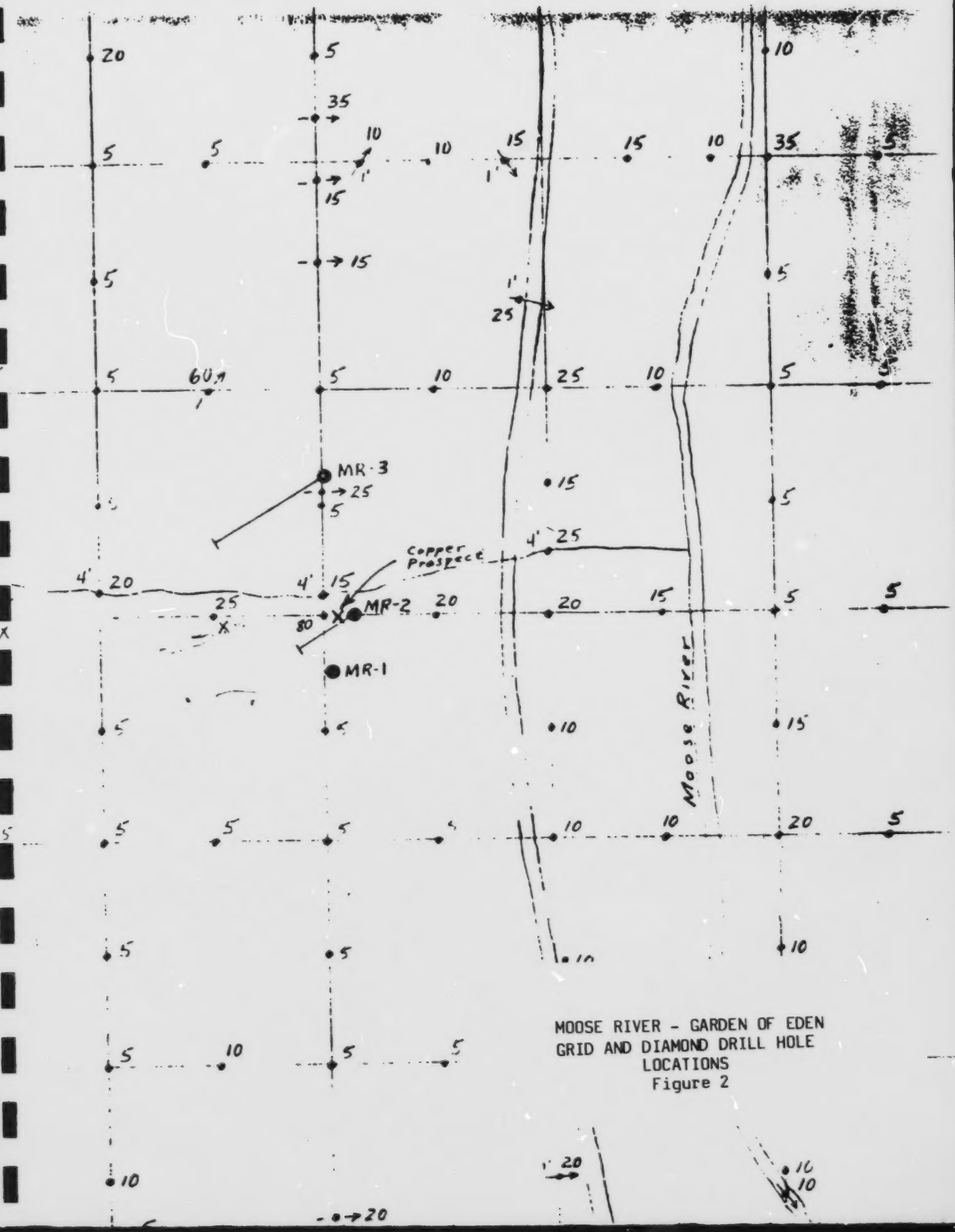
SIGNIFICANCE:

This occurrence is of little economic significance.
(1) Requires better grade Cu and Zn over a greater thickness. Continuity of existing grade and thickness has not been confirmed.

(2) Gold analyses suggest that the vein systems are weakly gold positive (Table 2).

The occurrence is of metallogenic significance for Cu and Zn and should be retained in the MOD files.


MOOSE RIVER - GARDEN OF EDEN E08-01
NTS 11E/08C
Figure 1
E08-01
Mount Adam
Garden
Moose
River
Campbells
Garden of Eden
Eden
Lake
Eden Lake
Rocky Mountain
Cemetery
Hunters Lake
Black L
The Gut
Little
River
347
NF



MOOSE RIVER - GARDEN OF EDEN
GRID AND DIAMOND DRILL HOLE
LOCATIONS
Figure 2

TI

TABLE 2
MOOSE RIVER - GARDEN OF EDEN ANALYSES

MOOSE RIVER/GARDEN OF EDEN Au + 33

87	MAGE	Ma	Sc	Cr	Fe%	Co	Ni	Cu	Zn	As	Se	Rb	Sr	Mo	Ag	Cd	Sn	Sb	Te	I	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Ir	Au	Th	U
	2021	0.62	7.16	156	3.6	38	<20	<100	0.2	<30	<2	<2	170	<200	<2	<2	<0.2	<30	<100	0.58	0.14	<10	<10	4.7	0.4	20	210	0.8	0.2	46	17	2.1	<4	1.4	0.7	1	0.5	0.5	0.5	<1	0.78	<2	<50	14	1.2	0.96	0.38
	2023	0.11	15	78	0.64	38	22	<100	0.7	<30	<2	<2	170	<200	<2	<2	<0.2	<30	<100	1.15	0.14	<10	<10	4.7	0.4	20	200	0.8	0.2	46	17	2.1	<4	1.4	0.7	1	0.5	0.5	0.5	<1	0.78	<2	<50	14	1.2	0.96	0.38
88	MR																																													
	9701	0.83	1.7	31	1.4	21	<20	<100	79.4	<30	<2	<2	6	<250	<2	<2	<0.2	<30	<100	1.0	0.2	<10	<10	<0.5	4.2	<50	330	2.9	3	73	27.0	5.1	1	0.8	2.3	4	0.7	0.6	<1	0.7	<1	<50	19	<0.5	7.5	2.0	1.4	33.2	13
	9702	0.11	15	188	0.1	29	21	<100	79.4	<30	<2	<2	158	<200	<2	<2	<0.2	<30	<100	1.0	0.2	<10	<10	<0.5	4.2	<50	330	2.9	3	73	27.0	5.1	1	0.8	2.3	4	0.7	0.6	<1	0.7	<1	<50	19	<0.5	7.5	2.0	1.4	33.2	13

MOOSE RIVER/GARDEN OF EDEN ATOMIC ABSORPTION

87	MAGE	V	Cr	Mn	Fe%	Co	Ni	Cu	Zn	As	Ag	Cd	Pb	Bi	Au ppb
	2021	47	89	1914	2.3	8	8	2350	483	<14	0.3	<0.2	15	<1	14
	2023	28	61	1174	4.4	18	15	2115	19	<1	0.3	<0.2	29	1	17
88	MR														
	9701	39	27	2960	1.6	20	3	2493	17	8	<0.1	<0.2	14	<1	12
	9702	92	81	366	7.0	26	17	41	21	4	0.2	<0.2	17	<1	24

COLLEGE GRANT

OCCURRENCE: COLLEGE GRANT E08-02 (Copper-iron)

LOCATION: 5026875 N571440 ENTS 11E/08D

ACCESS: (Ervine, 1987)

From its intersection with Highway 7 at South Lochaber, drive about 1.2 km southwestward on the road down the west side of Two Mile Lake to a gravel road leading westward. Drive westward another 3.0 km to an access road leading northward. Follow this road northward for another 3.0 km to a conspicuous farmhouse in an open blueberry field on the west side of the road. The prospect is in the open field 250 m southwest of the farmhouse.

REFERENCES:

Bourque, D., 1981. Metallogenesis and mineral deposits of the Antigonish Highlands, a detailed summary of field investigations. M.Sc. Thesis, Dalhousie University, NSDME Thesis 459, (OFR 383), 419 pp.

Cole, E. J., 1955. Report on metalliferous mines. NSDME Annual Report for 1954, p. 52.

Cole, E. J. and Grant, R. I., 1953. Report on metalliferous mines. NSDME Annual Report for 1952, p. 42, 53-54.

Ervine, W. B., 1987. College Grant, College Grant Mine. GSC Mineral Occurrence Datacard.

Kontak, D. J., 1976. The College Grant copper mine and its geologic setting. B.Sc. Thesis, St. Francis Xavier University, 35 pp.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highlands, 2 sheets, scale 1:50 000. GSC OFR 1181.

Murphy, J. B., Keppie, J. D., Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

NSDME AR 11E/08D 13-B-9, Copper, College Grant, Antigonish County.

TECTONIC ENVIRONMENT:

Sedimentary Environment:

The Stonehouse and Knoydart Formations, which are a part of the Arisaig Group, were deposited in a continental plate in a rifting subaerial to shallow submarine environment of uppermost Silurian to lowermost Devonian age.

Stonehouse Formation:
The base of the Stonehouse Formation is at the uppermost red shale unit of the Moydart Formation and the upper contact is placed at the uppermost green unit conformably overlain by redbeds of the Knoydart Formation.

The lower Stonehouse consists of green-grey to blue-grey micaceous siltstone, with well developed, laminated, commonly crossbedded tops. Blue-grey siltstone predominates in the middle of the formation and towards the top of the sequence minor red shale occurs.

Knoydart Formation:
The thickness of the Knoydart Formation is difficult to estimate because of non-

exposure of contacts, but it is at least 500 m thick. It consists of unfossiliferous red and grey-red polymictic conglomerate, siltstone and shale with minor green shale.

College Grant Pluton:
A small (2 km^2) diabase pluton cuts the Knoydart and Stonehouse Formations and is itself cut by the Chedabucto Fault. The diabase has undergone chlorite and epidote alteration and deformation. The age of the pluton is probably Devonian.

MINERALIZATION:

The age of mineralization was probably contemporaneous with fracturing. Formation of veins followed or occurred in the late stages of emplacement of the College Grant Pluton probably during docking of the Meguma Terrane during the Acadian Orogeny.

Quartz-carbonate veins up to 1.8 m thick cut the diabase and are known to occur in the surrounding sedimentary rocks. The gangue consists of white quartz with carbonate (ankerite and siderite) with clots of granular chlorite, abundantly mineralized by pods of specular hematite with lesser pyrite, chalcopyrite and very minor malachite. The veins, accompanied by mineralization, probably formed late during or shortly after emplacement of the pluton. The source of metals is speculative but Cu and Fe may be from the intrusive or Knoydart redbeds. Quartz and carbonate were probably derived from sediments.

DEVELOPMENT:

1874 Copper-stained quartz veined boulders discovered.

1876 Shaft sunk 26 m on a 1.8 m thick quartz vein.

1953 Northern Minerals Ltd. drilled 5 diamond drill holes to test the mineralization but very little was found (Cole et al., 1953).

1954 H. L. Isaacs conducted geological and geophysical surveys and drilled an additional 5 holes (Cole, 1955).

1970 - 1972 International Mine Services Ltd. conducted geochemical and geophysical surveys.

VEIN SYSTEMS:

The first vein 1.8 m wide had a 26 m shaft sunk on it. Subsequently five other veins 0.6 to 1.8 m thick were discovered. One strikes N72° W and the remainder strike N30° W. One of these veins was traced for 91 m and a 55 m shaft sunk on it. Several other veins ranging in thickness from 0.5 to 1.4 m were discovered at a distance of 274 m at 330° azimuth. Still farther in the same direction several other veins to 0.6 m have been exposed.

On the west side of Boggs Brook 1/2 mile to the east of the College Grant shaft, disseminated pyrite and carbonate vein material was encountered in an old adit.

On the Gillis farm, 3/4 mile east of the shaft (?), quartz veining with specularite and chalcopyrite occurs in a test pit; and 1 1/2 mile east of the shaft, the Felmate showing of pyrite and chalcopyrite was revealed by bulldozer stripping in 1952. One diamond-drill hole showed scattered sulphides.

PREVIOUS ANALYSES:

1876 Over 36 tonnes of ore averaging 10% Cu was hand cobbed from 220 tonnes of mined material and carted to Antigonish.

Prof How
Cu 19.21%
Fe 25.31%
S 22.65%
$CaCO_3$ 5.15%
O_2 etc. 4.67%
Gangue 4.67%

Picked sample of fine grained ore, Cu 31.9%

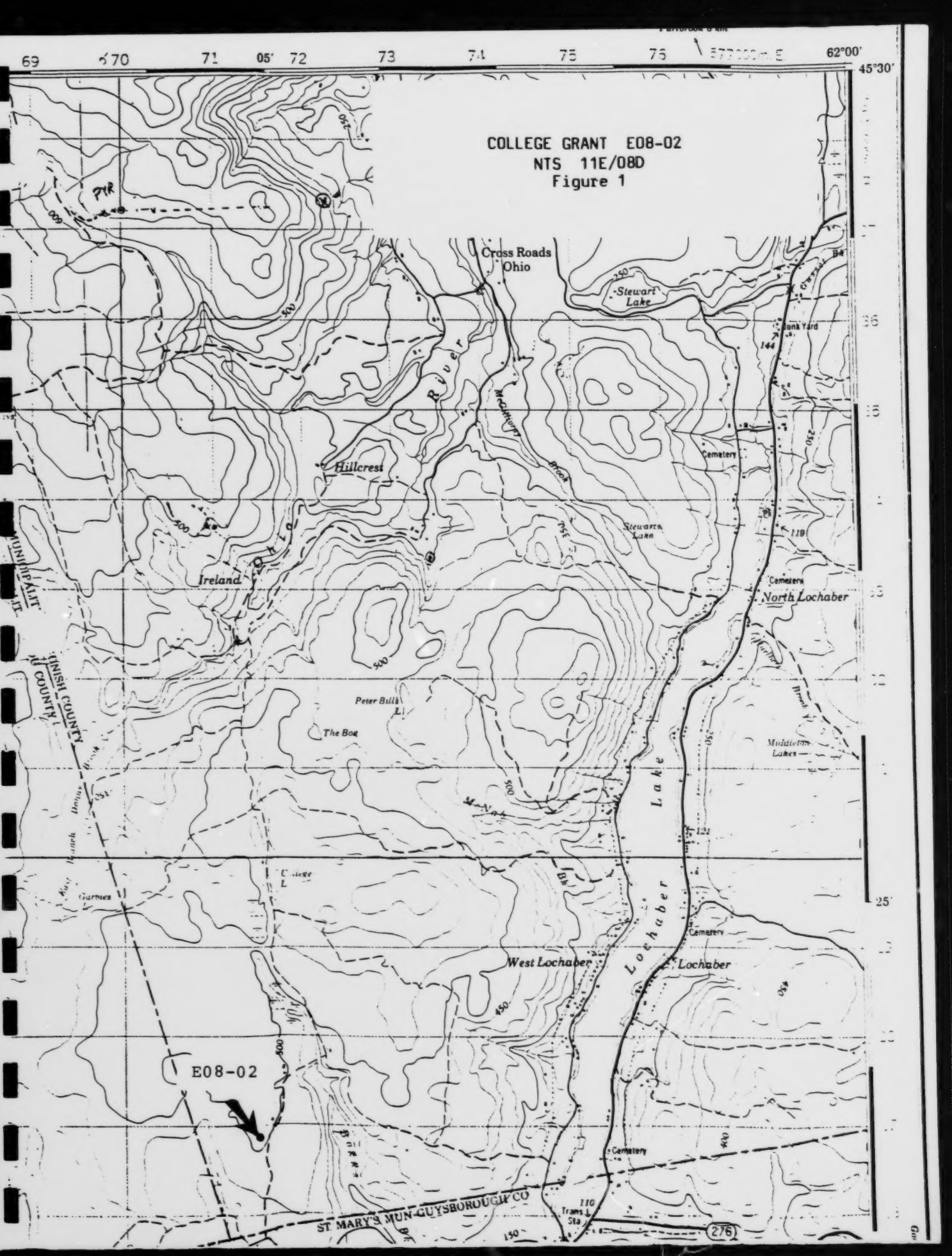
Swansea, 700 lbs Cu 19.87%

RESULTS OF 1987 FIELD CHECK: (Northcote)

TABLE 1

SAMPLES
87 CGRNT 2031 diabase wall rock
87 CGRNT 2032 mineralized vein, specularite, pyrite, chalcopyrite.

Table 2 lists Au + 33 neutron activation analyses for two samples: 87 CGRNT 2031 and 2032. No special analyses were made for copper and iron because the tenor of these metals is already well documented. Au + 33 analyses indicate no additional metal content of economic significance. An anomalous value of 70 ppb gold was obtained from the veins. This value, although not of economic significance, indicates that the vein system is gold positive and any further chemical analyses should include analyses for gold.


COLLEGE GRANT E08-02
NTS 11E/08D
Figure 1
Cross Roads
Ohio
Stewart
Lake
Hillcrest
Ireland
Peter Bull
L.
The Box
Stewart
Lake
Cemetery
North Lochaber
Lochaber
Lake
West Lochaber
Lochaber
Cemetery
Cemetery
Cemetery
E08-02
ST MARY'S MUN-GUYSBOROUGH CO
276
62°00'
45°30'

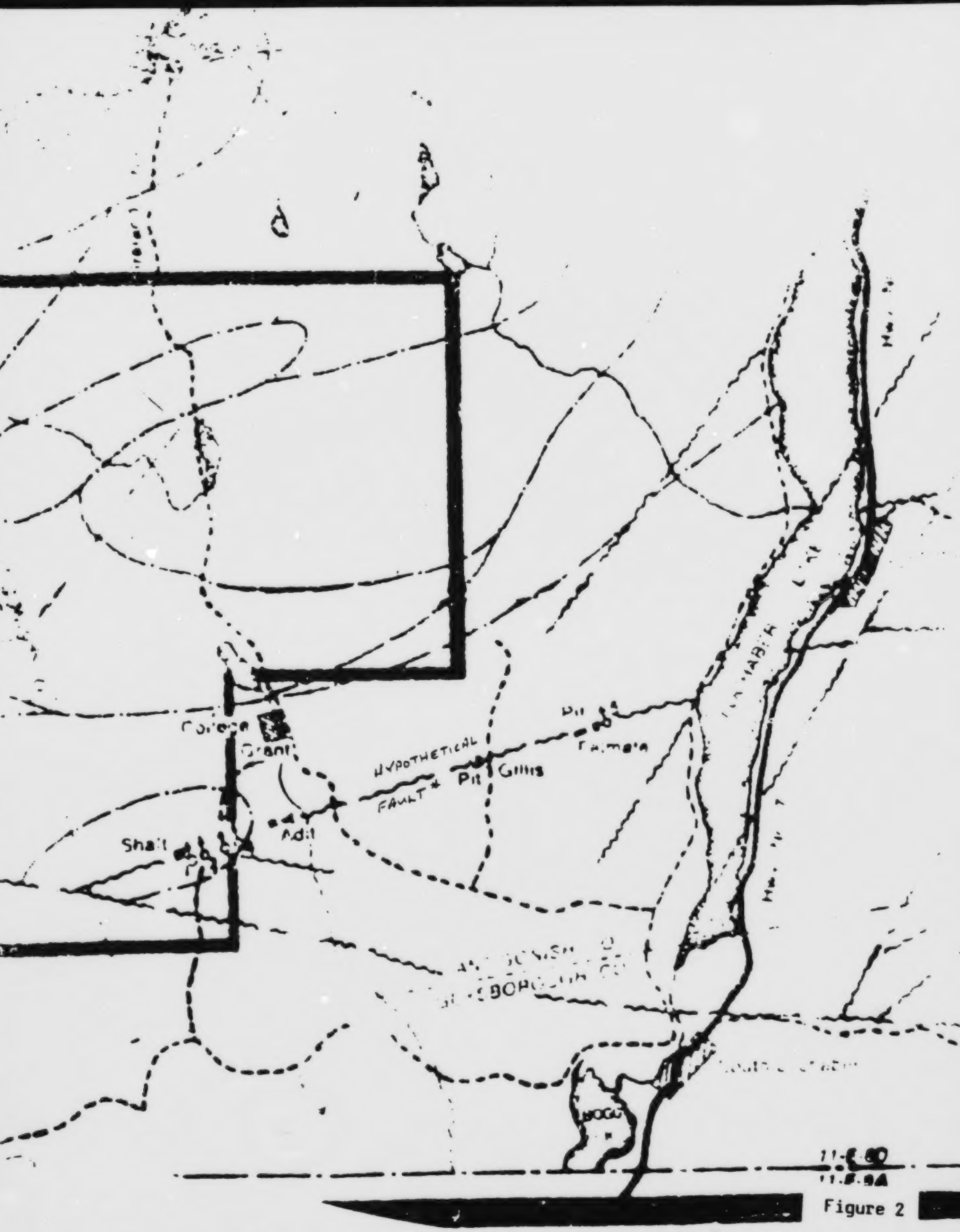


Figure 2

* HYPOTHETICAL FAULT
PROBABLY DOES NOT EXIST

T2

TABLE 1
COLLEGE GRANT ANALYSES

COLLEGE GRANT AU = 33

67	CGRNT	NS	SE																	
	2031	0.03	30.10	10	21.74	10	10	10	<1.10	4.76	20	<1	0	<2.00	17	<2.22	<2.00	10	10	
	2032	0.07	13	100		10	10	10	<1.00	7.14	20	<1	0	<2.00	17	<2.22	<2.00	10	10	

[redacted] [redacted] [redacted] [redacted] [redacted]

[illegible]

LOCHABER LAKE COPPER

OCCURRENCE: LOCHABER LAKE COPPER E08-03 (Copper)

LOCATION: 5028060 N 574340 E NTS 11E/08D

ACCESS:

From the bridge crossing at South Lochaber, drive north 2.4 km along the west side of Lochaber Lake. Follow a small bush access road westerly for 0.4 km up the side of the ridge to elevation about 375 m (Fig. 1). At this point a baseline extends 120 m northeasterly and 365 m southwesterly to Taylor Creek. A series of trenches and diamond-drill hole sites are shown on Figure 2; the first trench containing outcrop is about 35 m southwest of the access road. Diamond-drill hole data provide most of the geological information for this occurrence.

REFERENCES:

Boucot, A., Dewey, J. F., et al., 1974. Geology of the Arisaig area, Antigonish County, Nova Scotia. Geological Society of America, Special Paper 139, 191 pp.

Bourque, D., 1982. Metallogenesis and mineral deposits of the Antigonish Highlands. M.Sc. Thesis, Dalhousie University, N.S.D.M.E. OFR 383, 419 pp.

Ervine, W. B., 1987. Lochaber Lake Copper. G.S.C. Mineral Occurrence Data Card.

NSDME AR 11E/08D 13-B-19 (01) (02) Copper, Lochaber.
11F/05C 13-B-11 (07) Copper, Polsons Lake and Lochaber.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highlands. GSC Open File Report 1181, Sheets 1 and 2, Scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of Antigonish Highlands. G.S.C. Memoir.

Note: Most of the data in this Open File Report pertaining to the Lochaber copper prospect are derived from maps, sections, mine plans, soil geochemical survey plans, diamond-drill logs, and geologic description in NSDME Assessment Reports prepared by International Mine Services Ltd. for Great Horn Mining Syndicate Inc. This work was done by J. McMullin and M.J. Hooper and others and their contribution is acknowledged here.

TECTONIC SETTING: (Murphy et al., in press)

Regional mapping by Murphy indicates that the Lochaber Lake copper prospect is located within the Stonehouse Formation just below the gradational contact with Knoydart (Murphy, 1986). The Stonehouse Formation was deposited in a within plate, continental, extensional environment. Relationships between facies variations, centres of volcanic activity in the Arisaig Group and major faults suggests that these faults were at least moderately active at the time of sedimentation. Uppermost Silurian to lower Devonian Moydart, Stonehouse, Knoydart Formations show an increasing abundance of red shale and conglomerate which indicates a gradual shallowing of the environment of deposition and a return to subaerial deposition. Local slightly deeper basins in the uppermost Silurian may have accommodated deposition of limestone.

MINERAL POTENTIAL:

The Arisaig tectonic environment of shallow sedimentation with local slightly deeper calcareous basins and contemporaneous volcanism would support synsedimentary deposition of metals. A subsequent compressional environment

with related volcanism, plutonism and structure (faulting) during the Acadian Orogeny might generate hydrothermal mineralization.

GEOLOGICAL DESCRIPTION:

Moydart Formation: (Murphy et al., in press)

The Moydart Formation consists of a lower green and upper red member which are well exposed on the west side of Lochaber Lake. The thickness of the lower member is about 90 m and the upper member about 10 m.

The lower fossiliferous member consists of green sandstone, siltstone and shale. Shale is the dominant lithology especially towards the top of the member. The upper member consists of interbedded, mottled, moderately calcareous, hematitic, red, purple and green shale.

Stonehouse Formation: (Murphy et al., in press)

The Stonehouse Formation (upper Silurian) conformably overlies the Moydart Formation and underlies the Knoydart Formation. Its lower and upper contacts are defined by thick sequences of red shale. At Forbes Lake, 6 km south - southeast of Stellarton on the west side of the Antigonish Highlands, the Stonehouse Formation is approximately 600 m thick.

The lower part of the formation is predominantly green-grey to blue-grey, micaceous siltstone which commonly has well developed laminated tops with cross bedding. Blue-grey siltstone predominates in the middle of the formation whereas minor red shale occur towards the top.

Knoydart Formation: (Murphy et al., in press)

Boucot et al., (1974) document a gradational contact between the Stonehouse and Knoydart Formations in the Arisaig area. The formation is at least 500 m thick at Lochaber Lake and consists of red, purplish red and grey-red conglomerate, siltstone and shale with minor green shale.

Lochaber Lake Copper Section:

The lithology at the Lochaber Lake copper prospect, exposed in outcrop, trenches and penetrated by diamond-drill holes, does not correspond to the above descriptions of any of the Moydart, Stonehouse or Knoydart Formations. Here the section contains approximately 150 m of interbedded limestone, mudstone and siltstone underlain and overlain by maroon shale/siltstone (Fig. 3). The carbonate unit consists of dark grey to light greenish-grey, thinly laminated, argillaceous micritic limestone with interbedded grey, medium to irregularly bedded, micritic limestone and light green to white calcareous sandstone. A diabase dyke approximately 2 m thick, approximately parallel to bedding, occurs at or near the base of the section.

STRUCTURE:

The bedding strikes northeasterly and has a steep northerly dip (Figs. 2 and 4). A persistent fault strikes northeasterly and dips steeply northwesterly approximately following bedding. The main effect of the fault is to brecciate the limestone unit outward for about 10 m from the structure.

WORK DONE:

1970 Discovered by International Mining Syndicate (Great Horn Mining Corporation) through soil geochemistry survey.
1970-2 Soil geochemistry (grid), trenching (7), diamond drilling (7308 ft).
1982 Bluestack Resources, basal till sampling program, Cu, Pb, Zn, Ag, Ba.

MINERALIZATION:

Stratabound copper mineralization at the Lochaber Lake copper prospect occurs as disseminations and small blebs of sulphides along bedding planes and as sparse disseminations in the matrix of the lower 250 ft of the banded, argillaceous to silty limestone member (Figure 3). The mineralized zone dips an average of 77° northwesterly and is said to plunge to the southwest (NSDME AR 11E/8D 13-B-19 (01)). Mineralization consists mainly of chalcopyrite, malachite and pyrite. Minor bornite, sphalerite and galena have been reported. A cursory correlation of lithology to grade of mineralization indicates that the richer mineralization occurs in thin laminated impure argillaceous (chloritic) limestone. The purer cream-buff, brecciated (fault affected) limestone intervals are less mineralized suggesting no relationship between mineralization and faulting. However, an insignificant amount of sulphide mineralization with hematite occurs in quartz-carbonate veinlets cutting all lithologies. There is also no obvious relationship between diabase dykes and grade of copper mineralization.

METALLOGENESIS:

At present the genesis of the sulphide mineralization has not been resolved. The stratiform nature of the mineralization and the fact that it occurs at the base of a reducing horizon suggests a sedimentary syngenetic or diagenetic origin. Metals may have been deposited during sedimentation or derived from redbeds by dewatering during compaction with deposition in a reducing environment. Although there is no apparent direct relationship between tenor of mineralization and dykes, with College Grant copper deposit in mind, it is possible that magma emplacing diabase plutons and dykes may have been a source of metals. Other than scattered, wide spaced, sparsely mineralized veinlets, major structures (faults and accompanying brecciation) are unaltered and unmineralized.

MINERAL POTENTIAL OF LOCHABER LAKE COPPER PROSPECT:

The soil (Cu) geochemistry survey indicated a northeasterly-trending anomaly extending for approximately 1300 ft (Fig. 2). Subsequent trenching uncovered copper mineralization in argillaceous limestone and diamond drilling (16 holes totalling 7300 ft) gave drill indicated reserves of 2.29 million tons of 0.33% copper with an additional 3.44 million tons inferred to 1000 feet below the surface. Using a cutoff grade of 0.35% Cu, 237 000 tons of 0.474% Cu could be sent to the mill (NSDME AR 11E/8D 13-B-19 (01) by M.J. Hooper).

ANALYSES:

Analyses and Assays from 1987 Field Check:

Table 1 is a list of samples analyzed, with their lithologies and gives an indication of the elements that appear anomalous. Table 2 lists analyses for each sample. Au + 33, neutron activation analyses were run on each sample and assays for Cu were run on selected samples showing copper mineralization.

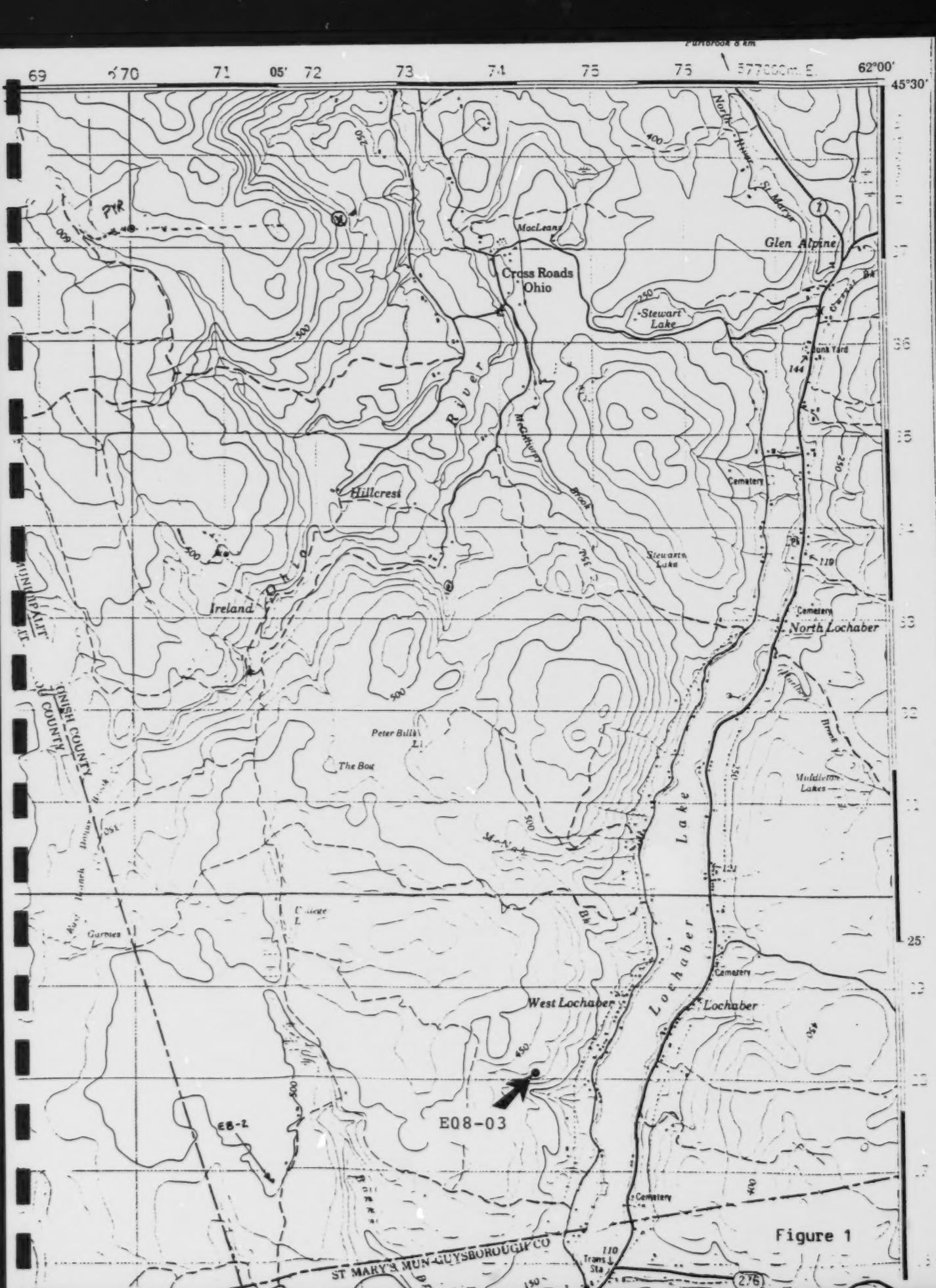
The highest copper values occur within the lower part of the limestone member and, obviously, support the analytical results from drill core. These results give no indication that any other metals of economic significance occur with the copper. It should be noted that weakly anomalous values of gold were evident in maroon shale and with limestone mineralization in Taylor Creek. Unfortunately gold, silver, lead and zinc assays (analyses) do not appear to have been routinely run in mineralized zones of diamond-drill core.

TABLE I

DESCRIPTION OF SAMPLES ANALYSED

87-LH	Lithology	Location:	Remarks
6001	Mrn sh, Hm lensds	Stream bed	Chips
6002	Qtz vnlt	" "	Chips 4 cm
6003	Maroon sh	" "	Chip (Au,U)
6004	Crm & m gry seds	" "	Chip (Ba,Zn)
6005A	Min ls, pyr, mal	" "	Chip Cu
6005B	Min ls, pyr, mal	" "	Chip Cu,(Au)
6006	Argil ls, pyr, cp, mal	" "	Chip
6007	Limestone	" "	Chip Cu,(Au)
6008	Argil, lensoids	" "	Chip (Ba)
6009	Maroon argil	" "	Chip (Cr)
6009A	Maroon argil	" "	Chip (U,Cr)
6010	Argil ls	" "	Chip
6011	Ls bx	" "	Chip
6012	Lmntd ls	Trench #7	Chip (Mo,As)Ag
6013	Lmntd ls	" "	Chip Cu
6014	Lmntd argil ls, pyr mal	" "	Chip Cu
6015	Reducing hor	DDH #7	Core*(As,Mo)
6015A	" "	" "	Core*(Zn,SC,Co,Ni)
6016	" "	" #6	Core*(Mo)
6017	" & oxid hor	" #12	Core*
6018	" " " "	" #1	Core*(As)
6018A	" " " "	" "	Core*
6019	Limestone	" #11	Core*(As,Mo)
6019A	Diabase	" "	Core*(Fe,Zn,Ni,Cr)
6020	Limestone	" #4	Core*(As)
6020A	"	" "	Core*
6020B	"	" "	Core*
6020C	"	" "	Core*(As)
6021	"	" #2	Core*(Mo,Au)
6021A	"	" "	Core*(Th,Cr)
6022	Lmntd argil ls	Trench #4	Chip (Cu,Co,As)
6023	Lmntd argil ls	" #3	Chip (Mo,Cu)
6024	" " "	" #2	Chip (Cu,As)
2043A	" " "	" #7	Chip

* Spilled core


69
70
71
05'
72
73
74
75
76
62°00'
45°30'
Cross Roads Ohio
MacLeans
Glen Alpine
Stewart Lake
Hillcrest
Ireland
North Lochaber
Cemetery
Peter Bulls L.
The Box
Lochaber Lake
West Lochaber
Lochaber
Garnies
E08-03
EB-2
ST MARY'S MUN-GUYSBOROUGH CO
Figure 1

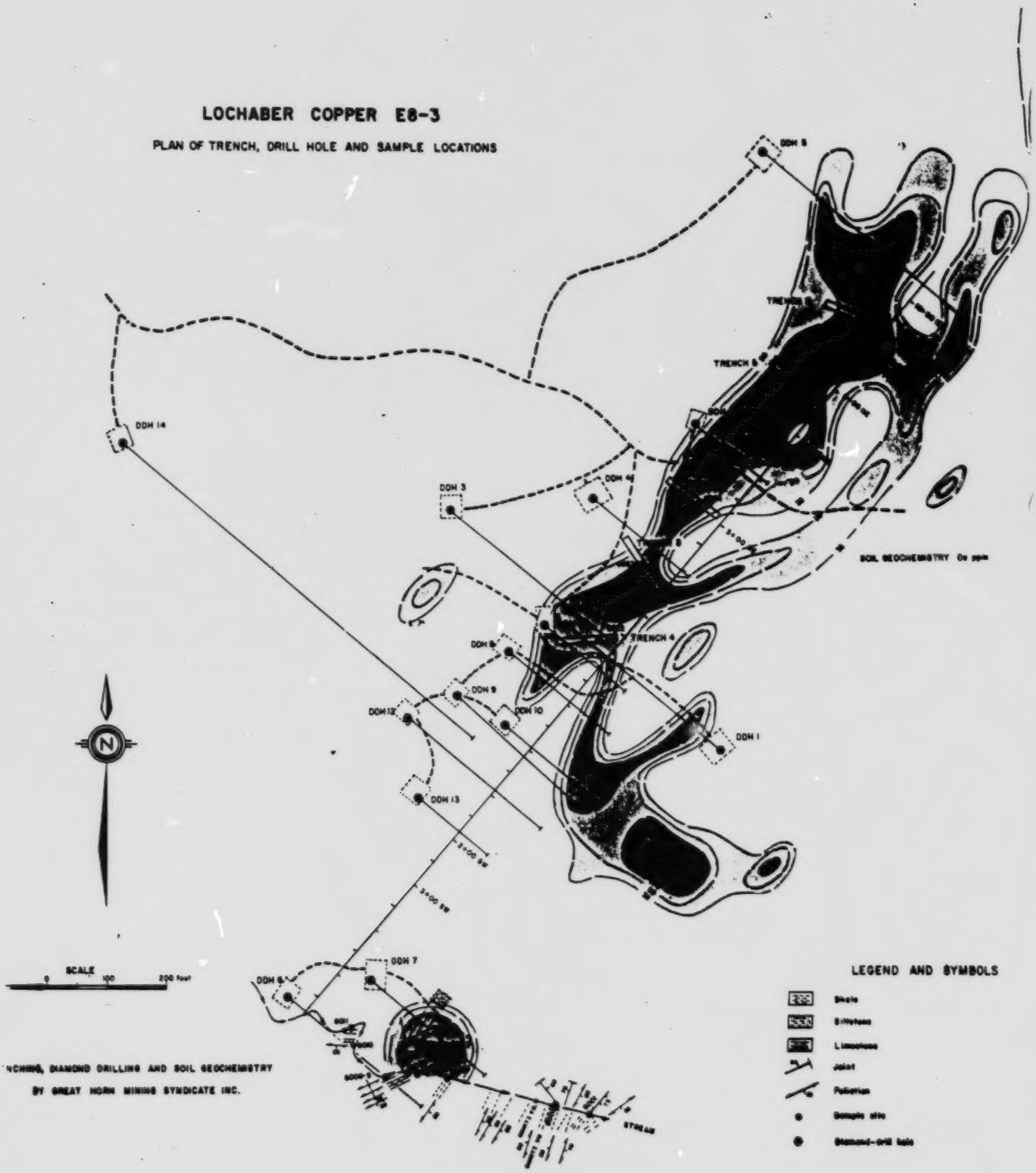
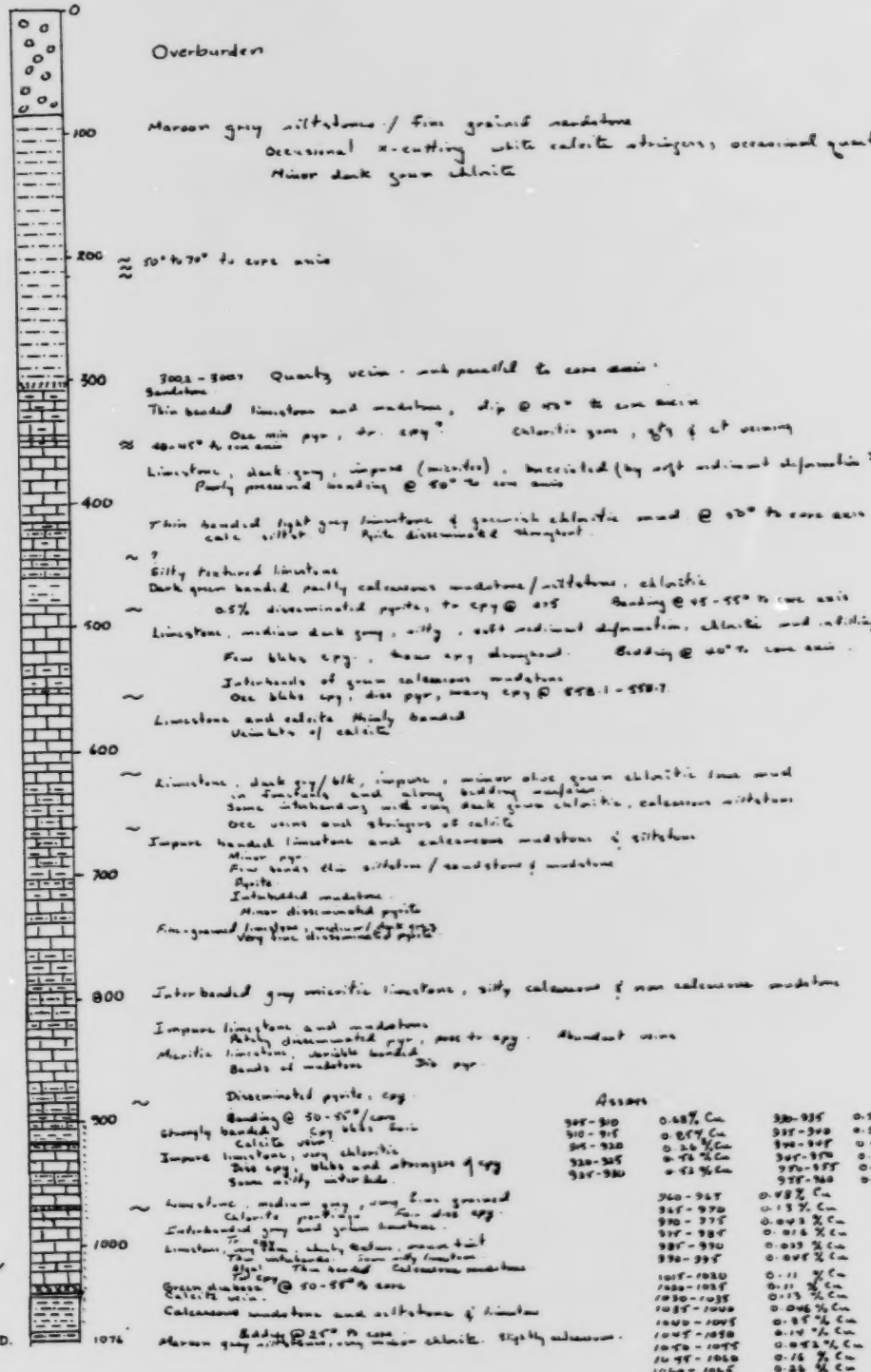

LOCHABER COPPER E8-3
PLAN OF TRENCH, DRILL HOLE AND SAMPLE LOCATIONS
DDH 6
TRENCH 5
TRENCH 6
DDH 14
DDH 3
DDH 4
SOIL GEOCHEMISTRY Cu ppm
TRENCH 4
DDH 8
DDH 9
DDH 12
DDH 10
DDH 1
DDH 13
N
SCALE
0
100
200 feet
DDH 5
DDH 7
STREAM
LEGEND AND SYMBOLS
Shale
Siltstone
Limestone
Joint
Fault
Sample site
Diamond-drill hole
NCHING, DIAMOND DRILLING AND SOIL GEOCHEMISTRY
BY GREAT HORN MINING SYNDICATE INC.

Figure 2

LOCHABER LAKE COPPER PROSPECT E8-3

Inclined hole bearing 130°; collar @ -54°, 500'@-52°, 774'@-42°, 1076'@-43.
Total Depth 1076 ft. Logged by J. McMullin 1991


0
Overburden
100
Maroon grey siltstone / fine grained sandstone
Occasional x-cutting white calcite stringers; occasional quartz.
Minor dark green chlorite
200
≈ 50° to 70° to core axis
300
3002 - 3007 Quartz vein - sub parallel to core axis
Sandstone
Thin banded limestone and sandstone, dip @ 45° to core axis
≈ 40-45° to core axis
One min pyr, tr. cpy°
Calcitic gouge, gft of clearing
Limestone, dark grey, impure (micritic), brecciated (by sgt sediment deformation?).
Poorly preserved bedding @ 80° to core axis
400
Thin banded light grey limestone & greenish chloritic mud @ 30° to core axis
calc silicate
Pyrite disseminated throughout
~ ?
Silty fractured limestone
Dark green banded partly calcareous sandstone / siltstone, chloritic
~ 0.5% disseminated pyrite, tr cpy @ 405
Bedding @ 45-55° to core axis
500
Limestone, medium dark grey, silty, soft sediment deformation, chloritic and infilling
Few blebs cpy, these cpy disrupted
Bedding @ 40° to core axis
Interbeds of green calcareous sandstone
~ Occ blebs cpy, diss pyr, many cpy @ 558.1 - 558.7
Limestone and calcite Mainly banded
Veinlets of calcite
600
~ Limestone, dark grey/blk, impure, minor olive green chloritic lime mud
in fractures and along bedding contacts
Some interbanding with very dark green chloritic, calcareous siltstone
Occ veins and stringers of calcite
~
Impure banded limestone and calcareous sandstone & siltstone
Minor cpy
Few beds elv siltstone / sandstone & sandstone
700
Pyrite
Interbedded sandstone
Minor disseminated pyrite
Fine-grained limestone, medium/dk grey
Very fine disseminated pyrite
800
Interbanded grey micritic limestone, silty calcareous & non calcareous sandstone
Impure limestone and sandstone
Abdly disseminated cpy, asso to cpy. Abundant veins
Micritic limestone, variable banding
Beds of sandstone Dis pyr
~ Disseminated pyrite, cpy
900
Banding @ 50-55°/core
Strongly banded Cpy blebs basic
Calcite veins
Impure limestone, very chloritic
Dis cpy, blebs and stringers of cpy
Some argillaceous interbeds
~ Limestone, medium grey, very fine grained
Calcite gouge/vein Occ dis cpy
Interbanded grey and green limestone
1000
Limestone, grey to dk grey, chalky texture, massive bed
Thin interbeds of some silty limestone
Algal Thin banded Calcareous sandstone
Tr cpy
Green diabase @ 80-85° to core
Calcite veins.
Calcareous sandstone and siltstone & limestone
T.D. 1076'
Maroon grey siltstone, very minor chloritic. Slightly calcareous.

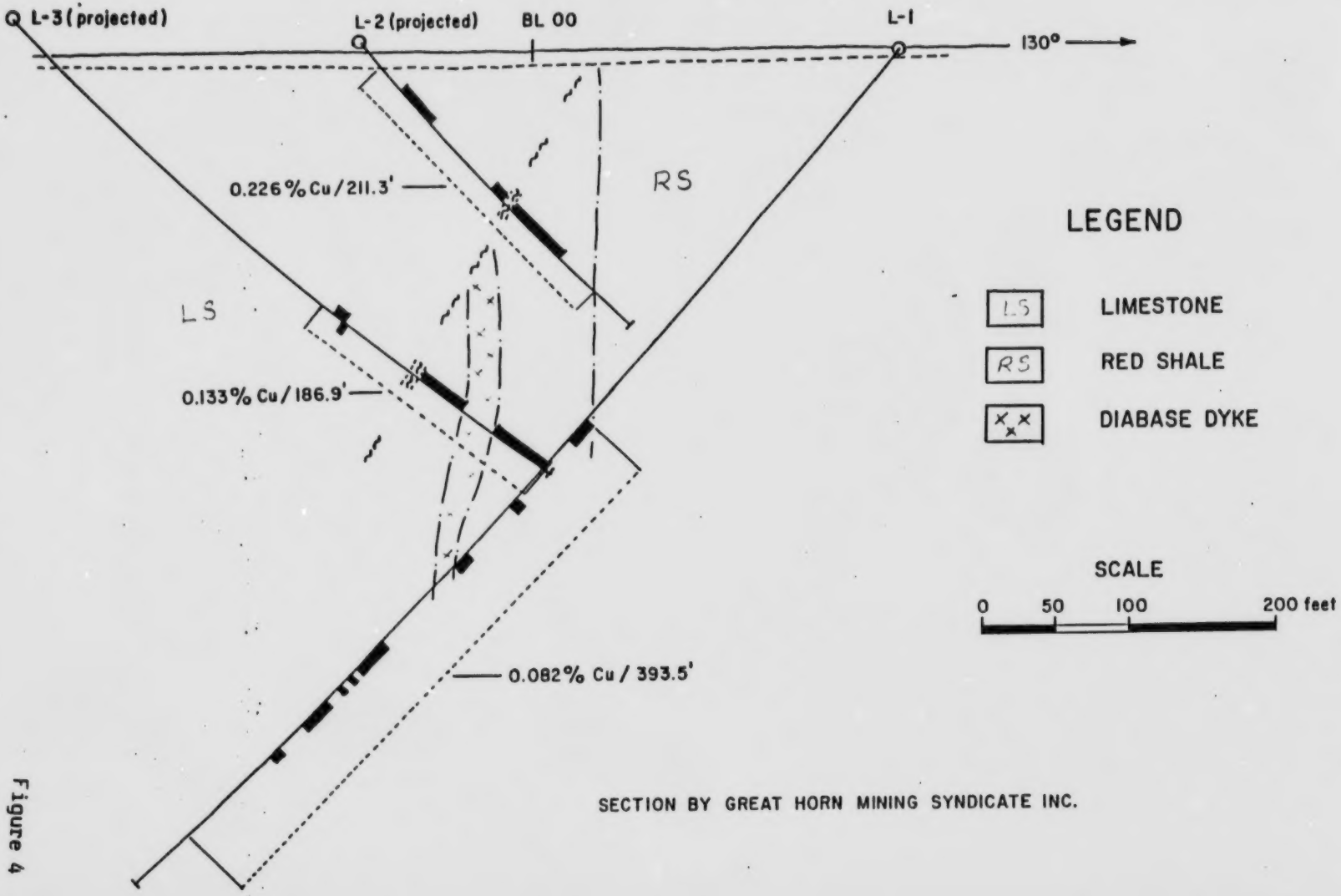
Assays

305 - 310	0.68% Cu		330-335	0.52% Cu	
310 - 315	0.85% Cu		335-340	0.58% Cu	
315 - 320	0.26% Cu		340-345	0.05% Cu	
320-325	0.18% Cu		345-350	0.35% Cu	
325-330	0.52% Cu		350-355	0.52% Cu	
			355-360	0.31% Cu	
360 - 365	0.98% Cu				
365 - 370	0.13% Cu				
370 - 375	0.043% Cu				
375 - 385	0.016% Cu				
385 - 390	0.039% Cu				
390 - 395	0.095% Cu				
1015-1020	0.11 % Cu				
1020-1025	0.11 % Cu				
1030-1035	0.13 % Cu				
1035-1040	0.046 % Cu				
1040-1045	0.85 % Cu				
1045-1050	0.19 % Cu				
1050-1055	0.052 % Cu				
1055-1060	0.16 % Cu				
1060-1065	0.26 % Cu				
1065-1070	0.011 % Cu				

True thickness of limestone section ≈ 500'

Figure 3

LOCHABER COPPER



SECTION BY GREAT HORN MINING SYNDICATE INC.

Figure 4

T3

TABLE I
LOCKHEED LUNAR ANALYSES

CROSS ROADS - OHIO

OCCURRENCE: CROSS ROADS - OHIO E08-05 (Copper-zinc-lead-silver)

LOCATION: 5037260 N 572330 E NTS 11E/08D

ACCESS:

Leave Trans-Canada Highway 104 at James River overpass and drive south 0.8 km to Beaver Meadow turnoff. Turn right and drive west 0.4 mile and cross bridge over Hartshorn Brook. Turn left on road at the west end of Hartshorn Brook bridge and drive 3 km south past east side of Camerons Lakes to road junction entering from the northeast (left). Continue driving south another 4 1/2 km to Donny Brook road junction. Turn southeast (left) and drive 2 km to Tozer Road. Drive easterly on Tozer Road past the pyritic zones to the end. From there proceed on foot easterly Brg 086° for 520 m to the edge of the shoulder of the ridge. The mineral occurrence, with the conspicuous workings and dumps, is located 40 m east of this point and extends for approximately 35 m along the hillside immediately below the ridge shoulder (Fig. 1).

REFERENCES:

Bourque, D., 1981. A metallogenic study of the Antigonish Area, Nova Scotia, with special reference to the copper occurrences of the Ohio-Sylven Glen Belt. M.Sc. Thesis, Dalhousie University, 419 pp.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highlands. GSC Open File 1181, Sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D., Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

NSDME AR 11E/09A 13-B-23 (04) Esso Minerals Ltd. 1975.
11E/09A 13-B-23 (04) Esso Minerals Ltd. 1978.

HISTORY:

1884 An opening was made on a deposit of yellow and grey copper ore that yielded 1120 lbs of copper, 6 2/3 dwts of gold, and 3 oz silver/ton.
1885 M. F. Egar, Dr. Johnston and J. McNeil worked on promising copper deposits in the area.
1886 Fletcher described the occurrence, said to have yielded the above.

TECTONIC SETTING:

Keppoch Formation: (Murphy et al., in press).

The Keppoch Formation, of late Precambrian age, comprises approximately 3000 m of bimodal volcanic or volcanic-derived rocks which are subaerial (Fraser Brook Member) at the base and submarine (Moose River Member) toward the top. The felsic Frasers Brook rocks range from coarse, light grey, pink or red, volcanic breccia and agglomerate with a few flows, likely extruded close to vents, grading outwards into ignimbrite, and distal medium to fine-grained tuff and lahar. Interbedded basic rocks are composed of basalt and basaltic-andesite. The Moose River Member contains green volcanic pyroclastic rocks with greywacke and dark, porcellaneous, finely laminated mudstone (Murphy et al., in press).

The felsic rocks appear to have resulted from anatexis of the crust by the rising mafic magma. The interlayered basaltic andesites and basalts, derived from the mafic magma, are of two types: continental aphyric tholeiitic and porphyritic calc-alkalic. The mudstone and greywacke are inferred to have been deposited

by turbidity currents in a marine environment. The Keppoch Formation rocks are thought to have been formed in a rifted volcanic arc environment (Murphy et al., in press).

MINERAL POTENTIAL:

Similar rocks elsewhere host economic mineral deposits both in the subaerial and submarine environments. There are worldwide examples of subaerial, felsic, volcanogenic, hydrothermal, base and precious metal deposits with subvolcanic, comagmatic porphyry-related orebodies. Submarine, bimodal volcanism and sedimentation on the other hand, may be accompanied by deposition of bedded volcanogenic, multi-element, massive sulphides such as Kuroko type polymetallic sulphide and precious metal deposits.

The subaerial felsic rocks of the Keppoch Formation host mineral occurrences ranging from broad pyritic zones in distal volcanogenic units to Cu-Zn-(Pb-Ag) mineralization hosted in secondarily brecciated felsic, lithic, tuffaceous breccia, at Cross Roads - Ohio.

GEOLOGY: (Northcote and DeMont, field check 1987)

Mineralization at Cross Roads - Ohio is hosted by a felsic, lithic tuffaceous breccia of the Fraser Brook Member of the Keppoch Formation of Hadrynian age (Murphy, 1986). These host rocks are similar to those at the Tozer Road occurrence but lack felsic ignimbrite and basaltic andesite flows (Fig. 2). The section is cut by nearly flat-lying, narrow branching basic dykes (Fig. 2). Polymictic lithic fragments in the felsic breccia show wide variation in colour, texture and composition (varied modal K-spar and quartz content) and range from felsic lithic tuff, ignimbrite to lava. These fragments are composed of the same variety of felsic rocks of flow and pyroclastic origin as at Tozer Road. Hematitic clasts are common.

Alteration:

The host rocks are altered by sericite with lesser epidote, chlorite, carbonate and locally very weak silica alteration.

Structure:

Fracture patterns in outcrop and cataclastic textures in thin sections show multiple stages of brecciation and fracturing resulting in breccia stockworks, with or without accompanying mineralization. Late brecciation superimposed on the primary volcanogenic breccia by subsequent structural events is termed secondary breccia. The matrices of the secondary stockwork breccias are composed of small fragments and grains of sericitic host rock in a calcareous matrix. Within this matrix are pods, a few cm wide and tens of cm long, of coarse crystalline calcite, lesser barite and minor quartz. There is no other obvious evidence to suggest strong hydrothermal alteration.

MINERALIZATION:

The volcanogenic breccia is weakly mineralized by sulphides but the most significant mineralization occurs in later secondary breccias.

Volcanic breccia:

Pyrite, with traces of chalcopyrite, is commonly disseminated within lithic fragments of the primary breccia but shows varied abundance in adjacent fragments. Weakly disseminated pyrite, with traces of chalcopyrite and sphalerite, also occurs in the volcanogenic breccia matrix.

Secondary breccia:

Sulpide mineralization within the secondary breccia, on the other hand, is much stronger, ranging up to several per cent Cu and Zn in selected samples over widths of a few cm at intervals of several metres apart. The longest zone of

most continuous mineralization occurs in secondary brecciation for approximately 4 m across the excavation face and is followed by the short upper adit (Fig. 2). Mineralization consists of chalcopyrite, sphalerite, pyrite, marcasite, covellite, hematite, sparse galena and arsenopyrite with coarse interstitial gangue of calcite, lesser barite and minor quartz (Table 1). Adjacent stockworks are pyrite-rich, chalcopyrite-rich or sphalerite-rich, forming a zonation of mineralization from one stockwork to the next (Fig. 3). Table 1 summarizes the characteristics of lithologies and mineralization at Cross Roads - Ohio.

ANALYSES:

Samples were taken of mineralized and unmineralized host rock and stockworks and a brief description of what these samples represent is given in Table 1. The mineralized samples are selected type samples, generally of the richest mineralization taken across narrow widths. Analyses of these samples are, therefore, not representative of grade but give an indication of what metals are present.

Samples were run for a total of 48 elements and 10 oxides by a combination of DC Plasma, Direct Irradiation/INAA, Atomic Absorption, X-ray Fluorescence and conventional assay. These analyses were done at Bondar Clegg Laboratories, Ottawa. Samples were analyzed for gold using neutron activation methods and mineralized samples were rerun by fire assay - atomic absorption methods.

Selected samples from very narrow widths, 2 or 3 cm, of secondary breccia gave notably high values for copper, 9.62%; zinc, 31.01%; and lead, 0.59% but are not representative of mining widths. Silver values give a maximum of 10.2 ppm, almost a third of an ounce per ton, and are associated with high lead and zinc values. The maximum gold value is 20 ppb, with two 15 ppb and another 10 ppb, not significantly higher than for the pyritic zones at Tozer road, and these values do not confirm the high gold values reported by Fletcher. High barium values reflect the barite content of secondary breccias. The analyses show no additional elements of economic significance.

GENESIS:

Differences in pyrite concentration among adjacent primary lithic fragments suggest that this mineralization, similar to some of the mineralization in the Tozer Road occurrence, survived from an earlier Frasers Brook felsic volcanic unit which was subsequently brecciated and redeposited as polymictic, lithic, tuffaceous breccia. It is probable that most of the sulphides within the primary breccia matrix are also of fragmental origin.

The origin of mineralization in the secondary breccia, however, is even less clear. It may also be volcanogenic, related to pulses of activity in a nearby volcanic centre; a result of remobilization and concentration of metals from the primary breccia; related to later structurally controlled hydrothermal events, or, as Bourque suggests, related to once overlying mineralization in the basal Windsor breccia (Bourque, 1982, p. 279-281). The reason for metal zonation between adjacent secondary breccias is also unknown but the close spacing suggests multiple episodes of brecciation and mineralization by solutions of differing metal content. The low intensity of hydrothermal alteration in the wall rocks and secondary breccia matrix must be considered when possible origins of mineralization are proposed for this occurrence. Stable isotope and fluid inclusion studies are necessary to attempt to resolve this problem.

CROSS ROADS - OHIO E08-05
NTS 11E/08D
Figure 1

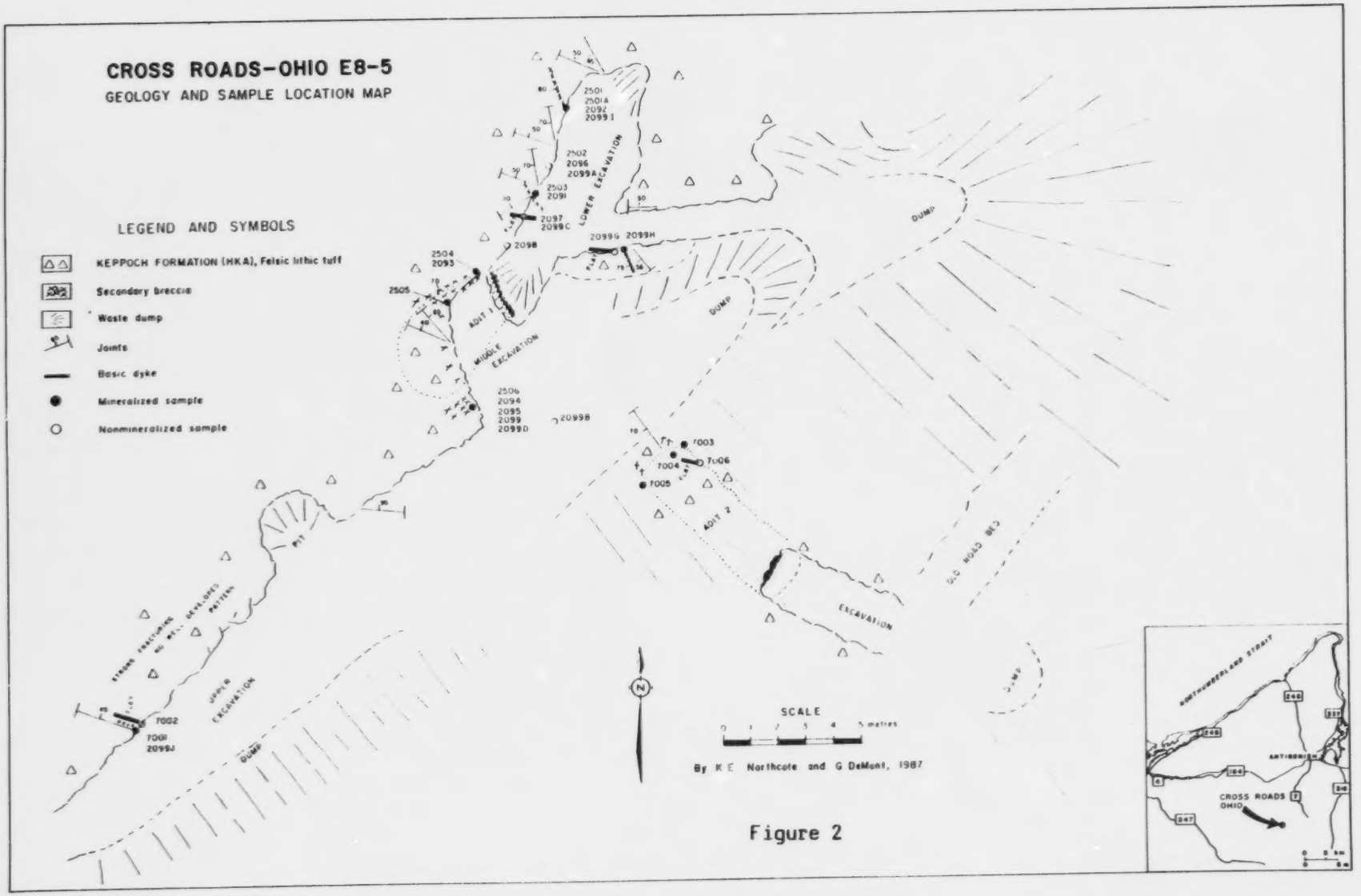

CROSS ROADS–OHIO E8-5
GEOLOGY AND SAMPLE LOCATION MAP
LEGEND AND SYMBOLS
KEPPOCH FORMATION (HKA), Felsic lithic tuff
Secondary breccia
Waste dump
Joints
Basic dyke
Mineralized sample
Nonmineralized sample
2501
2501A
2092
2099I
2502
2096
2099A
2503
2091
2097
2099C
2098
2099G
2099H
2504
2093
2505
2506
2094
2095
2099
2099D
20998
7003
7004
7005
7006
7002
7001
2099J
LOWER EXCAVATION
MIDDLE EXCAVATION
UPPER EXCAVATION
ADIT 1
ADIT 2
PIT
DUMP
EXCAVATION
OLD ROAD BED
STRONG FRACTURING NO WELL DEVELOPED PATTERN
N
SCALE
0 1 2 3 4 5 metres
By K E Northcote and G DeMont, 1987
NORTHUMBERLAND STRAIT
CROSS ROADS OHIO

Figure 2

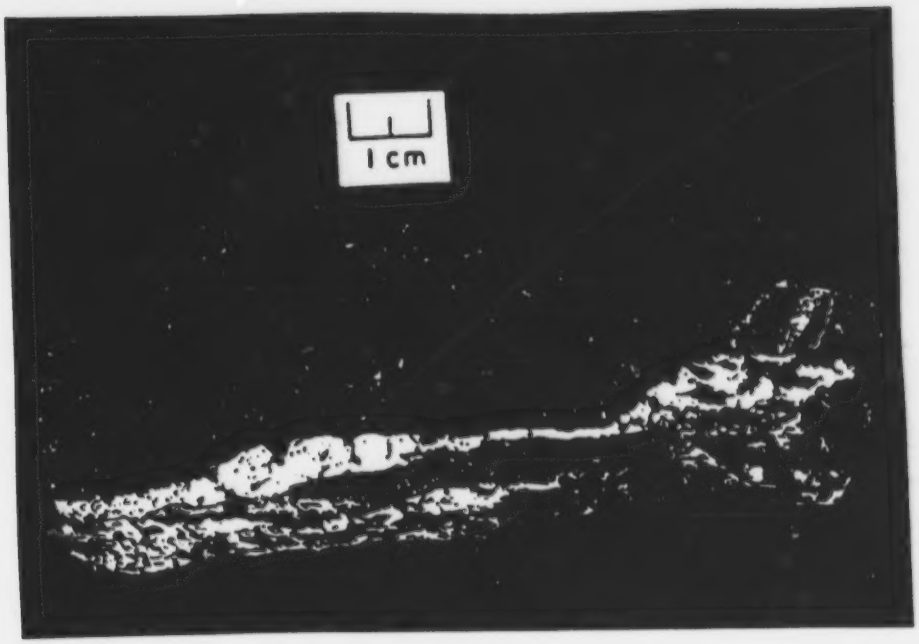


Figure 3A Cross Roads - Ohio Sample 87CROH-2094. Chalcopyrite (white) filling fractures and secondary matrix among felsic lithic tuff fragments. Fine pyrite grains are disseminated in some lithic fragments and in the matrix of the felsic lithic tuff.

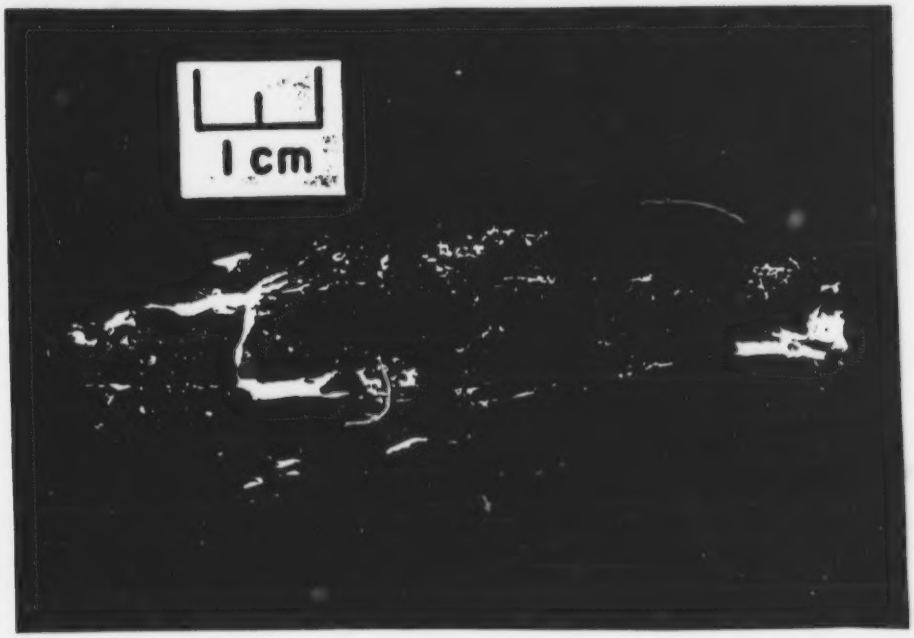


Figure 3B Cross Roads - Ohio Sample 87CROH 2094 Chalcopyrite (white) filling fractures and as disseminated grains in secondary breccia matrix between felsic lithic tuff fragments

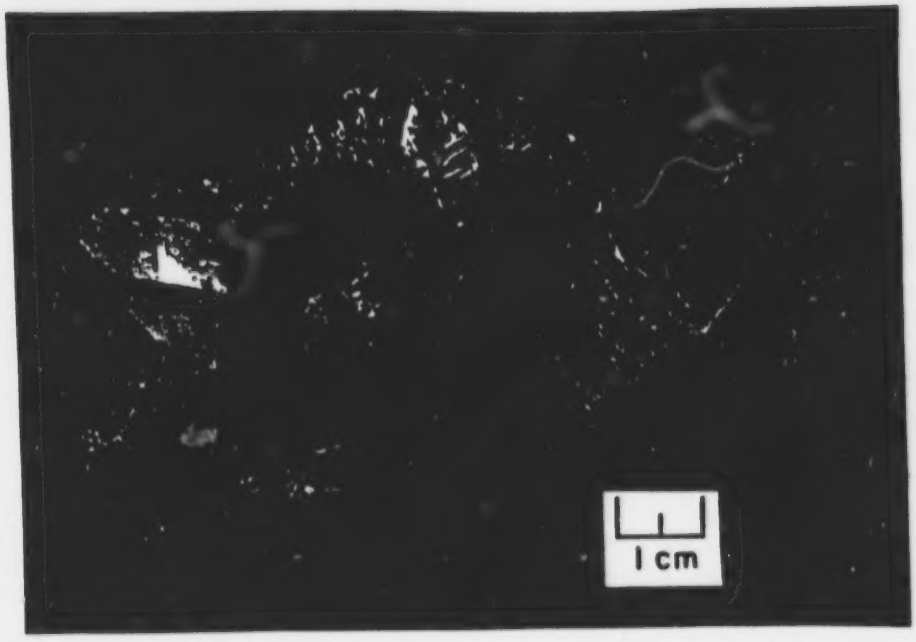


Figure 2C Cross Roads - Ohio Sample 87CROH 250J Disseminated and near-massive sphalerite (black grains and masses) surrounding margins of lithic breccia fragments and in coarse calcite with lesser barite.

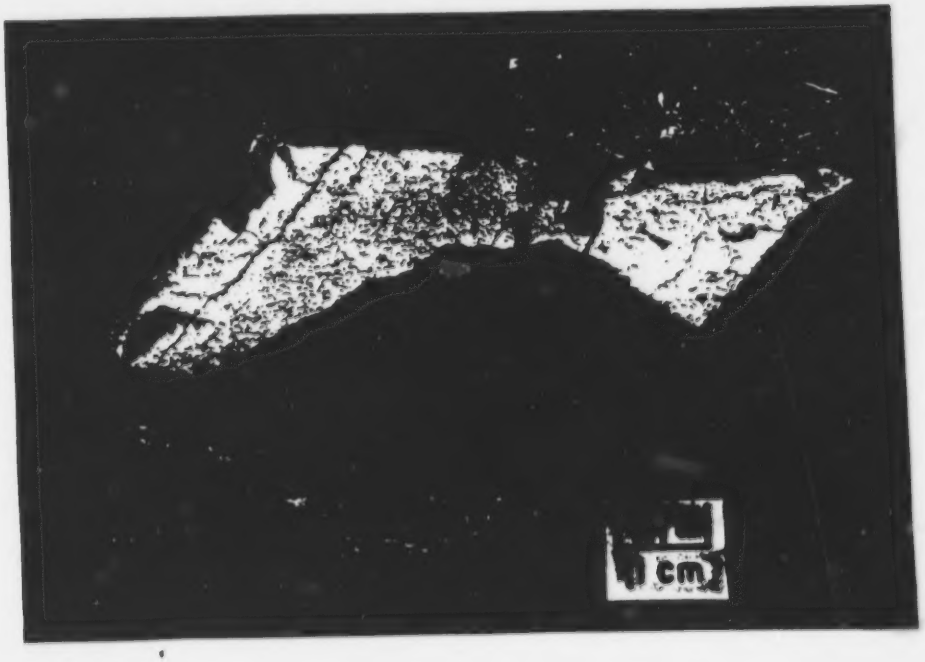


Figure 2D Cross Roads - Ohio Sample 87CROH 250J From same location as 2A above but with light reflecting off the polished surface so that the near-massive sphalerite forming the secondary breccia matrix appears light coloured.

T4

TABLE 1
PETROGRAPHIC SUMMARY

	LITHOLOGY	ALTERATION	MINERALIZATION FORM	MINERALOGY	SAMPLE NO.
CROSS ROADS - OHIO Keppoch Formation:					
	(1) Felsic volcanogenic tuff bx, polymictic Hematitic fragments	Sericite, chlorite, quartz, epidote	Disseminated clusters in lithic fragments Disseminated in tuff matrix.	Pyrite ilmenite (leucoxene)	2092, 2094, 2504, 2505, 2506, 7003 7004, 7005, 7006, 7007
	(2) Secondary breccia matrix	Carbonate, barite quartz	Disseminations, pods	(a) Pyrite/marcasite chalcopyrite (tr) sphalerite (tr)	2092, 2501
			Zoning shown by different mineral assemblages in stockworks a few metres apart.	(b) Sphalerite galena (tr) pyrite/marcasite (minor) chalcopyrite (minor)	2091, 2503
				(c) Chalcopyrite covellite, malachite manganese oxide (pyrite, sphalerite) arsenopyrite, hematite	(2506), 2093 2094, 2095, 2099D, 2099F,
	(3) Basic dyke	No thin section	----------	----------	2099C

E88-85

TS

CROSS ROADS - OHIO MAJOR AND TRACE ELEMENT ANALYSES

CROSS ROADS OHIO: * 35

97 CROH	Ni(X)	Cu	Zn	Pb	Fe(X)
2091	6.78	197.00	2080.00	4470.00	10.00
2092		133.00	762.00	722.00	N.D.
2093			3410.00	8270.00	
2094		2200.00	3910.00	2850.00	
2095		2000.00	1904.00	103.00	
2099R					
2301					
2302					
2304					
2305					
2306					
7003	258	1623	438	16	
7004	7468	1673	9920	26	
7005	148	1468	9320	353	
7006	7721	1702	10536	3643	
7007	848	114	1598	264	0.64

CROSS ROADS OHIO: AA ANALYSES

97 CROH	Mn	Cu	Zn	Pb	Au(ppb)
2091		197.00	2080.00	4470.00	10.00
2092		133.00	762.00	722.00	N.D.
2093			3410.00	8270.00	
2094		2200.00	3910.00	2850.00	
2095		2000.00	1904.00	103.00	
2099R					
2301					
2302					
2304					
2305					
2306					
7003	258	1623	438	16	
7004	7468	1673	9920	26	
7005	148	1468	9320	353	
7006	7721	1702	10536	3643	
7007	848	114	1598	264	0.64

97 CROH	U	Sr	Zr	Nb	Sn	Ge	Y	In	La	Ti(X)
2091										
2092										
2093										
2094										
2095										
2099R										
2301										
2302										
2304										
2305										
2306										
7003	17	102	278	23	3	18	35	<1	<18	0.27
7004										
7005										
7006										
7007	172	311	219	24	<1	18	41	<1	<18	0.05

CROSS ROADS - OHIO: WHOLE ROCK

97 CROH	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL %
2099C	47.4	2.21	17.3	14.9	0.2	5.21	6.86	1.46	2.43	0.16	3	101.53

CROSS ROADS-OHIO: ASSAYS

97 CROH	Cu	Pb	Au(oz/T)
2091	1.56	31.00	
2092	0.38	0.01	
2093	0.62	0.34	
2094	0.39		
2095	1.12		
2099D			
2301	0.01		
2302	0.14		
2304	14.20		
2305			
2306			
2099C			<0.01

CROSS ROADS OHIO: ADDITIONAL ANALYSES

97 CROH	Fe(X)	La	Ba
2099C	6.8	35	1.3

CROSS ROADS - OHIO: DC PLASMA

97 CROH	Mo(X)	Mn(X)	Ag
7003	1.41	0.08	ND
7007	2.04	0.147	ND

97 CROH	Au(ppb)
2099C	990

LOWER CALEDONIA

OCCURRENCE: LOWER CALEDONIA E08-06 NTS 11E/08B (Anomalous Pb-Zn-(Au))

LOCATION:

#1	5012520 N	552980 E (Kelly Brook)
#2	5012540 N	552530 E (Rocky Brook)
#3	5012660 N	552605 E (St Mary's River)
#4	5012440 N	552240 E (Forest Access)

ACCESS:

Drive west towards Caledonia on highway from bridge crossing St Mary's River just west of Lower Caledonia, 4.3 km to Kelly Brook.

Location #1 (Figs. 1 and 2)
A forest access road leads south up the east side of Kelly Brook leaving the highway a couple of hundred m east of the brook. It passes through coarse grained foliated granite and swings westerly into metasediments which are on the south side of the granite contact. The access road flanks the east side of Kelly Brook about 500 to 650 m from the highway. At this point there is an outcrop area on the east side of the road and exposures occur intermittently along both sides of the brook. An outcrop has been modified by excavation on the east side of the stream.

Location #2 (Figs. 1 and 2)
Drive west towards Caledonia 0.4 km from Kelly Brook to Rocky Brook. A new Kelly Lake Road leaves the highway at this point and immediately crosses to the west side of Rocky Creek. The old caved adit and trenches are located up a grown-in mine access road approximately 150 m from the highway on the west shoulder of the valley flanking a swamp in Rocky Brook. Alternatively, drive up the new Kelly Lake access road for 200 m then proceed on foot for 75 m, bearing 045°.

Location #3 (Figs. 1 and 2)
Is a shallow trench cut into bedrock north of the Caledonia Highway running down the bank to St. Mary's River water edge, approximately 80 m east of the mouth of Rocky Brook.

Location #4 (Figs. 1 and 2)
Follow the next road, 0.5 km west of Kelly Lake Road, south for 400 m from the highway to a bench area where the road swings south and up a hill. On the bench, approximately 75 m east of the road, there are knolls of granitic outcrop. A few metres farther east dumps are visible from old trenches and a shaft in metasediments. A short spur road, now obscured by logging, leads past the south side of the workings and up the hill to an old drill site.

REFERENCES:

NSDME Annual Report 1937. p. 110-111
1938. p. 98-100
1946. p. 63
1951. p. 55

NSDME Assessment Reports AR 11E/08B 21-G-28 (00-05)
AR 11E/08B 58-G-02 (01-02)

GEOLOGIC ENVIRONMENT:

The Lower Caledonia workings are situated in Meguma Group metasediments on the south side of the St. Mary's graben where they are in fault contact with

Horton Group sediments to the north. The Meguma is intruded by elongate plutons of coarse grained, foliated, 2-mica (biotite and muscovite) granite. Adjacent to the intrusive contact the sediments have been metamorphosed to biotite hornfels.

Both units, the Meguma metasediments and intrusives, are cut by irregular, discontinuous quartz veins. In the metasediments they range from a fraction of a cm to several cm in width, wider in granite to 0.6 m where they are irregular lensoidal and tend to follow the northeasterly foliation.

Veins in granite:	060°/85° NW 2 to 4 cm, 8 cm. 070°/72° NW
Foliation in granite:	103°/V 085°/V 085°/80° N 080°/65° N
Veins in metasediment:	073°/55° NW 1 cm 095°/75° N 9 cm
Foliation in metasediments:	095°/70° N biotitic hornfels.

EARLY WORK:

The trenches, shaft and adit at the four locations tested a number of the veins.

There are reports of fine and coarse gold in highly contorted quartz veins in slate and gold was reported mortared from overburden (NSDME Annual Report 1946, p. 63; NSDME AR 11E/08 21-G-28(00)). Sphalerite and galena are also reported from the vein systems.

Production:
1934-36 1 ton 2 cwt produced 1 oz 23 dwt 18 gm Au.

Old assays:

(1) A. McLaren, Tract 21 Claim D, west boundary obtained values of 0.243 oz Au/ton in a 60 ft chip sample.

Two additional samples from the same area gave values of 0.91 and 0.60 oz Au/ton.

(2) J. T. Meagher, 1400 ft east of McLaren's sample from a 20 ft chip sample obtained values of 0.24 oz Au/ton.

(3) Hemany mines, OFR, a bulk test of 290 lbs gave values of 0.26 oz Au/ton, 0.10 oz Ag/ton; and a value of 0.37 oz Au/ton from screen.

RESULTS OF 1987 FIELD CHECK: (Northcote; Northcote and DeMont)

During the 1987 field examination the workings were relocated with respect to new and modified road systems (Fig. 2). Minimal sampling was done (Table 1, Fig. 2). Analyses were done by a combination of Direct Irradiation/INAA and Atomic Absorption analyses at Bondar Clegg Laboratories, Ottawa.

The analyses failed to confirm economic values for either gold or base metals (Table 2). The best values obtained are as follows:
Sample 87 LWCD 2013 of quartz vein in granite at Kelly Creek gave an Au value of 54 ppb.

Sample 87 LWCD 2064 of iron stained metasediment from trench on south side of St. Mary's River east of Rocky Brook gave an As value of 1270 ppm.
Sample 88-LWCD 8903 of metasediment and quartz from old adit on Rocky Brook gave Zn values of 336 to 400 ppm and a Pb value of 197 ppm.

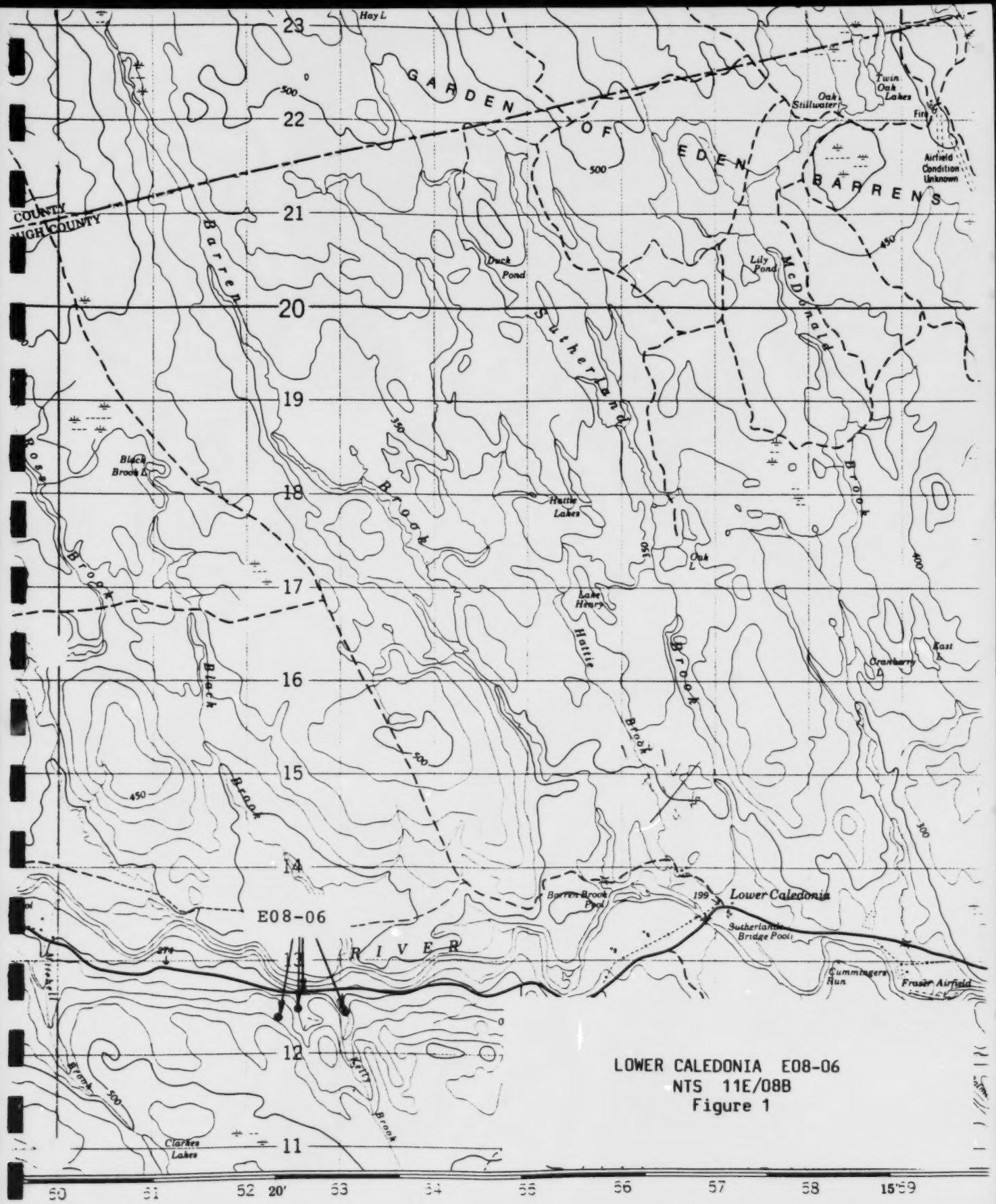
POTENTIAL:

DeMont notes that there are unexplained Pb and Zn soil geochemical and EM and IP anomalies in the area. These are also untested for Au.

A more exhaustive assessment is required for this area in view of the earlier reported precious and base metal values.

TABLE 1
LOWER CALEDONIA SAMPLES

Sample	Lithology	Remarks
87 LWCD	Location #1 Kelly Creek	
2013	Quartz vein in granite	chip sample
2014	Quartz vein in metasediment	chip sample
2015	Granite	chip sample
2016	Hornfels	chip sample
2017	Metasediment	chip sample
2018	Quartz veinlet in metasediment	chip sample
2065	Quartz vein in metasediment	chip sample (9 cm)
2066	Quartz vein in granite	chip sample
2067	Granite	chip sample
87 LWCD	Location #2 Adit and Trench Rocky Brook	
2061	Quartz from dump	chip sample
2062	Metasediment from dump	chip sample
2063	Metasediment and quartz from dump	chip sample
88 LWCD		
8901	Quartz from dump	chip sample
8902	Quartz from dump	chip sample
8903	Metasediment and quartz from dump	chip sample
87 LWCD	Location #3 South shore St Mary's River	
2064	Iron stained metasediment (trench)	chip sample
87 LWCD	Location #4, Main area (west) shaft and trenches	
2019	Quartz from dumps	chip sample
2020	Metasediment from dumps	chip sample



LOWER CALEDONIA E08-06
NTS 11E/08B
Figure 1

Routes

:e, all weather ..... paved, toute saison .....

dual highway
2 chaussées séparées

more than 2 lanes
plus de 2 voies

LOCHABER
NOVA SCOTIA

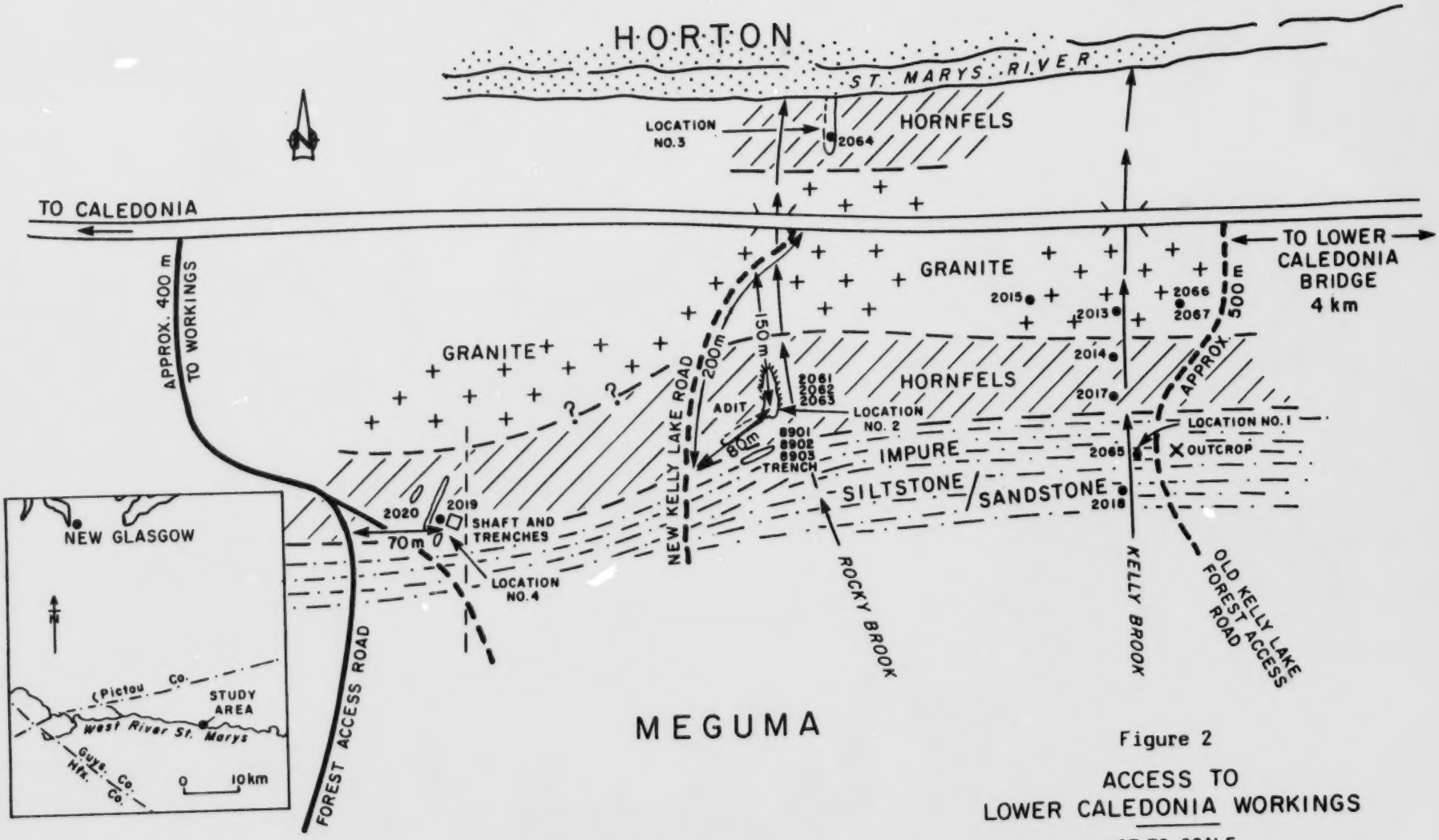


Figure 2

ACCESS TO
LOWER CALEDONIA WORKINGS

NOT TO SCALE

May, 1967 K.E. Northcote

T6

TABLE 2
LOWER CALEDONIA ANALYSES

LOWER CALEDONIA Au + 33

| 87 LHCO | MAX | | |

IRELAND IRON

OCCURRENCE: IRELAND E08-14 (1) Hematite Bridge Occurrence
(2) Pyrite West Ireland Occurrence

LOCATION: (1) 5032400 N 571250 E NTS 11E/08D
(2) 5033700 N 571950 E

ACCESS:

(1) By road to bridge crossing at Ohio River/East Branch Donny Brook, 2.25 km southwest of Hillcrest. Mineralization (hematite) in the form of fracture fillings (veinlets) in quartz monzonite/granodiorite (Fig. 1).

(2) By road 1.5 km southwest of Hillcrest along road leading southwesterly up the west side of Ohio River at Ireland. Then go northwesterly for 0.83 km up a forest access road keeping to the right at the first branch. Then walk northeasterly to stream. Pyritic (hematitic) monzogranite/granodiorite crops out at several places in and along both banks of the stream (Fig. 1).

GEOLOGIC ENVIRONMENT:

Both occurrences are in the Ohio Pluton of late Precambrian/Cambrian age (533 ± 19 Ma [Rb-Sr] Cormier 1979, Murphy et al., in press). The pluton is composed of medium grained equigranular monzogranite/granodiorite, up to 10% mafic minerals (biotite and hornblende). Aplitic phases are common near the margins of the pluton. The chemistry of the pluton is consistent with a mature volcanic arc or post collisional granite (Murphy, Keppie, Hynes, in press).

Both occurrences, particularly the bridge occurrence, is situated close to the present basal Windsor - Ohio Pluton unconformity, which in the case of the bridge occurrence must have been approximately at or a few metres above the present level of erosion.

GEOLOGY OF THE OCCURRENCES:

(1) Bridge occurrence: Massive monzogranite/granodiorite outcrops at the bridge and is medium grained with conspicuous quartz and chloritic mafic aggregates. It is abundantly fractured and locally sheared. The rocks are iron-stained, with metallic hematite and powdery iron oxide (some of which may be the result of weathered pyrite) in drusy crackle fractures. Subcrops of shattered, abundantly iron-stained granodiorite occur along the road.

(2) West Ireland occurrence: A number of outcrops of fine- to medium-grained, monzogranite/granodiorite with varied mafic content extend for a length of > 250 m in and along the stream. These rocks contain varied amounts of disseminated pyrite and locally late fractures are filled with powdery iron oxide. The pyrite is probably primary, related to the pluton and the iron oxide in late fractures the result of weathering.

TABLE 1

Samples

Bridge Occurrence:

88 IR-101 Iron-stained, hematite veined, quartz-rich monzogranite.

West Ireland Occurrence:

88 Ir-201 Granodiorite; fine- to medium-grained, mafic rich 25 -30%, chlorite-epidote alteration.

88 IR-203 Granodiorite; 25% mafic, chloritic, disseminated pyrite.

88 IR-204 Granodiorite; crackle fractures with metallic hematite and powdery iron oxide.

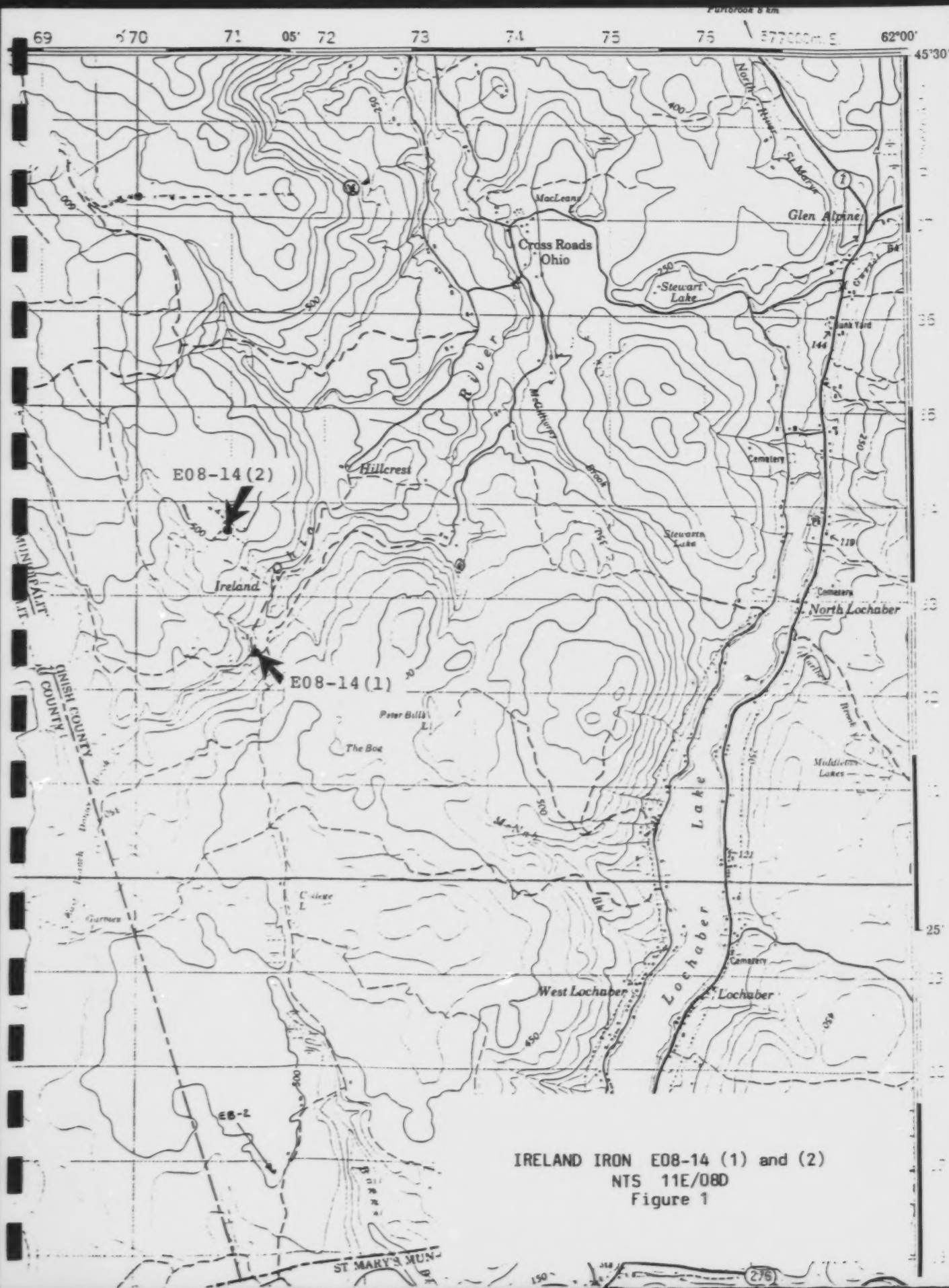
88 IR-205 Granodiorite; equigranular granodiorite, disseminated pyrite.

RESULTS OF ANALYSES:

Samples from the two Ireland occurrences were analyzed by neutron activation for Au + 33 elements plus atomic absorption methods for Cu. No significant metal values were obtained.

MINERAL POTENTIAL:

The occurrences are of metallogenic significance for iron but analyses indicate nothing of economic significance.



IRELAND IRON E08-14 (1) and (2)
NTS 11E/08D
Figure 1

T7

TABLE 2
IRELAND OCCURRENCES ANALYSES

IRELAND OCCURRENCES Au + 33

88-IR	MoX	Sc	Cr	FeX	Co	Ni	Zn	Ag	As	U	Rb	Zr	Mo	Sn	Cd	Sb	Sb
101	3.32	3.5	220	1.8	6	<20	<100	17	55	3	130	<200	N	<2	<5	<100	3.1
201	3.98	NN3	120	7.1	12	AA	150	11	AAAA	P.AA	72	<410	1	A	AAA	<1100	999.7
NN03	U.U57	NN41	1NN8	8.4N	11N	AAA8	1180	78	AAAA	ANNN	6838	AA2N	NNN	AAAH	AAA8	<1100	999.7
NN04	U.U57	NN41	1NN8	8.4N	11N	AAA8	1180	78	AAAA	ANNN	6838	AA2N	NNN	AAAH	AAA8	<1100	999.7
203	3.73	N7.1	64	8.5	2N	AA8	178	10	AAA8	ANNN	68	AA8	NNN	AAAH	AAA8	<1100	4.4

IRELAND OCCURRENCES ATOMIC ABSORPTION

88-IR	Cu	Zn	Ag	Pb	Au	ppb
101	4	33	<0.1	14		<5
201	6	103	<0.1	4N47		AAA8
NN03	1N4	614	0.2			
NN04	1N4	614	0.1	4N47		AAA8
203	42	72	0.1	4		AAA8

[redacted]

Sc	Sb	Ta	Cs	Ba	La	Ce	Sm	Eu	Tb	Yb	Lu	Hf	Ta	W	Ir	Au ppb	Th	U	WT
<100	3.1	<10	2.6	1000	55	65	7	<1	1.1	5	0.4	7	1.3	2	<50	4	12	2.5	35.41
<100	0.7	<10	5.2	850	53	61	10	[illegible]	1.3	5	0.6	6	0.7	<1	<50	<2	4.9	1.3	37.03
<100	0.5	<10	1.4	610	52	61	9.10	[illegible]	1.4	4	0.66	6	0.67	<1	<50	<2	4.1	1.1	40.17
<100	0.4	<10	1.3	620	56	61	10	[illegible]	1.6	4	0.66	5	0.66	<1	<50	<2	4.18	1.3	41.26
<100	0.4	<10	4.1	510	51	62	10	[illegible]	1.6	5	0.65	5	0.66	<1	<50	<2	5.15	0.9	41.14

MOOSE RIVER IRON

OCCURRENCE: MOOSE RIVER IRON E08-17 (Iron)

LOCATION: 5034220 N 551910 E NTS 11E/08C

ACCESS:

There are two routes to the mineral occurrence. From Highway 347 bridge crossing Moose River just north of Garden of Eden, drive north on Highway 347 for 4.7 km to Moose River Road sign. At this point an access road leads to the right (northeasterly), crosses Moose River (bridge presently out). From the east side of the creek go directly north for approximately 0.4 km to 8 m high waterfall in tributary that enters Moose River from the east. The start of mineralized outcrop is at a waterfall, which is approximately 90 m up tributary from its junction with Moose River, and extends up the river for an additional 100 m.

The second access to the occurrence begins at a farmhouse an additional 0.75 km northwest of the Moose River road sign. An access road through the farm crosses Moose River and follows the north side of the tributary within 100 m of the mineralized zone.

REFERENCES:

Bourque, P. D., 1979. Metallogenesis and mineral deposits of the Antigonish Highlands. NSDME OFR 383.

Bourque, P. D., 1981. A metallogenic study of the Antigonish area, Nova Scotia, with special reference to the copper occurrences of the Ohio-Sylven Glen belt. Unpublished M.Sc. Thesis, Dalhousie University, NSDME Thesis 459, 420 pp.

Murphy, J. B., 1986. Geology of the Antigonish Highlands. Geological map, G.S.C. OF 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. G.S.C. Memoir.

GEOLOGY OF THE OCCURRENCE:

Mineralization occurs in the Fraser Brook Member of the Keppoch Formation (Murphy, 1986). The exposure is massive fragmental (pyroclastic) felsic volcanics which have been crackle brecciated with metallic hematite (and possible minor sulphides) as disseminations, coatings and partial fracture fillings.

Mineralization is structurally controlled, younger than Hadrynian?, probably related to major faulting of middle to late Devonian age (Murphy et al., in press).

RESULTS OF THE 1988 FIELD CHECK (Northcote and DeMont)

Table 1 lists and gives a description of six sets of chip samples taken across 100 m of outcrop. Samples were run by Direct Irradiation/INAA for Au + 33 additional elements and by Atomic Absorption analyses for 14 elements, including Au by Fire Assay/Atomic Absorption.

The results of these analyses are listed on Table 2. No values of economic significance are evident. Iron values range from 1.8 to 11%, Co to 38 ppm, V to 280 ppm, Mn to 1944 ppm, and Au to 12 ppb.

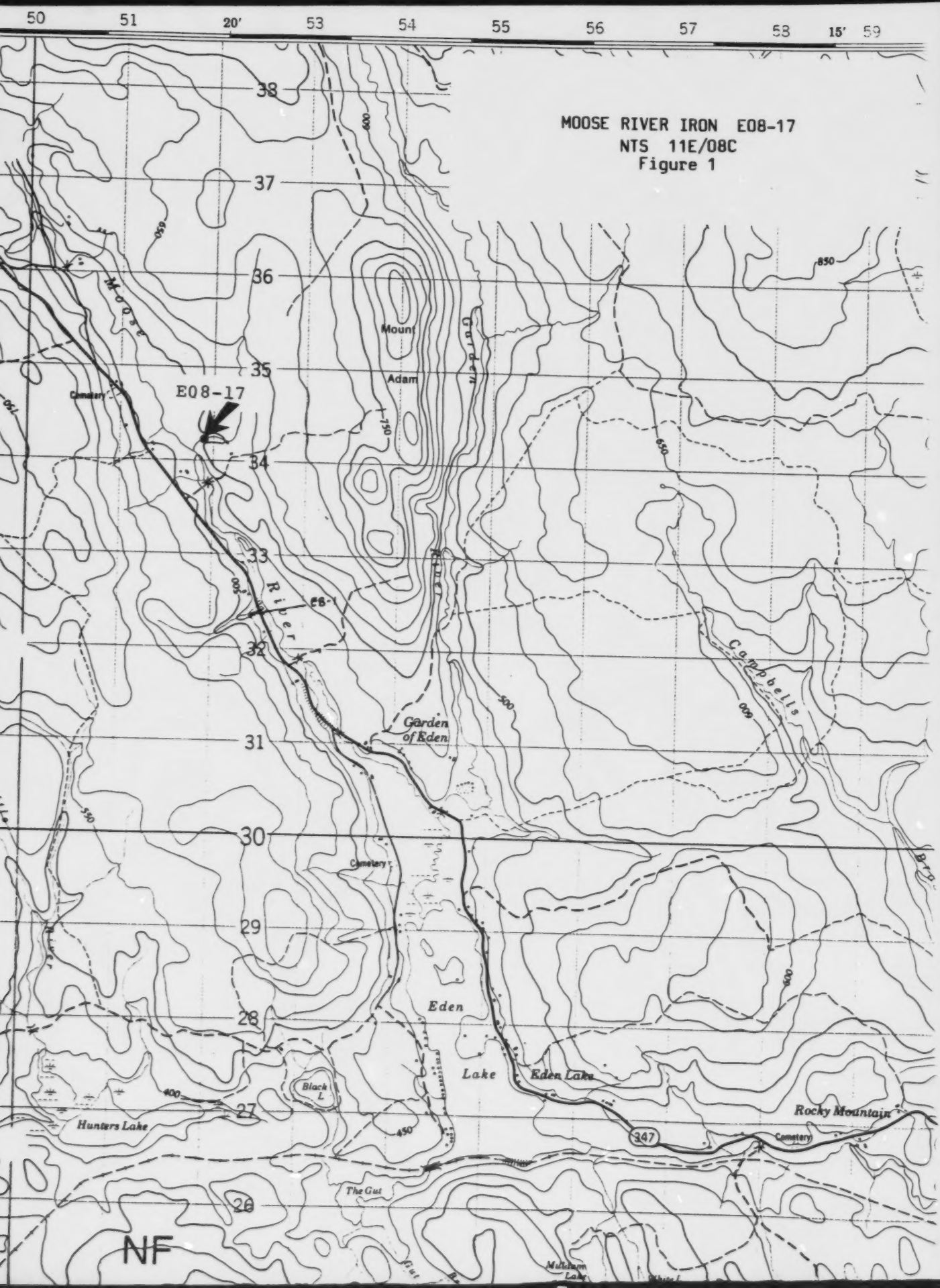

MOOSE RIVER IRON E08-17
NTS 11E/08C
Figure 1
E08-17
Mount Adam
Moose River
Garden of Eden
Campbells
Eden Lake
Rocky Mountain
Hunters Lake
Black L
The Gut
Cemetery
347
NF

TABLE 1
MOOSE RIVER IRON SAMPLES

Sample No.	Distance from Moose River	Lithology	Mineralization	Type
88 MR 8601	155 m	Pyroclastic felsic volcanics	Hematite veinlets	Chip
8602	140 m	Pyroclastic felsic volcanics	Hematite veinlets	Chip
8603	125 m	Pyroclastic felsic volcanics	Hematite veinlets	Chip
8604	115 m	Pyroclastic felsic volcanics	Hematite veinlets	Chip
8605	105 m	Pyroclastic felsic volcanics	Hematite veinlets	Chip
8606	90 m	Pyroclastic felsic volcanics	Hematite veinlets	Chip

TABLE 2
MOOSE RIVER (E88-17) ANALYSES

| | | |

CALLAHAN BROOK

OCCURRENCE: **CALLAHAN BROOK E08-26 (Copper) (New occurrence replacing former reported gold-bearing quartz veinlets in shale which are not at this location).**

LOCATION: **5033370 N** **573420 E** **NTS 11E/08D**

ACCESS:

Follow road on the east side of Ohio River south for 3.75 km from Cross Roads - Ohio to a cluster of farm buildings where the road narrows. Walk southeasterly for 250 m to stream course (not apparent at first). The first outcrops occur where the brook forms a gully and blocks of limestone and granite are visible. Limestone, overlying about 2 m of breccia, is in contact with Ohio Pluton. The granitic rock outcrops discontinuously for about 250 m upstream.

REFERENCES:

Keppie, J. D., 1982. Tectonic map of the province of Nova Scotia. NSDME published map, scale 1:500 000.

Kirkham, R. V., 1978. Base metal and uranium distribution along the Windsor-Horton contact, central Cape Breton Island, Nova Scotia. GSC, Paper 78-1B, p. 121-135.

Ponsford, M. A. P., 1983. Geologic, fluid inclusion, and stable isotope study of a carbonate-hosted lead deposit at Pembroke (Glenbervie), Colchester County, Nova Scotia. Unpublished B.Sc. Thesis, Dalhousie University, 65 pp.

Ravenhurst, C. and Zentilli, M., 1987. A model for the evolution of hot (200°C) overpressured brines under an evaporite seal; the Fundy, Magdalen Carboniferous basin of Atlantic Canada and its associated Pb-Zn-Ba deposits. *In* Sedimentary Basins and Basin - Forming Mechanisms, eds., C. Beaumont and A. J. Tankard. Canadian Society of Petroleum Geologists, Memoir 12, p. 335-349.

Smith, L. and Collins, J. A., 1984. Unconformities, sedimentary copper mineralization and thrust faulting in the Horton and Windsor Groups, Cape Breton Island and Central Nova Scotia. 9th International Congress of Carboniferous Stratigraphy and Geology, 1979. Compte Rendu, v. 3, p. 105-116.

TECTONIC ENVIRONMENT:

Calcareous Windsor Group rocks of Carboniferous age unconformably overlay Precambrian Keppoch volcanics and the Ohio Pluton of Precambrian or younger age in the southeast Antigonish Highlands. Farther basinward the unconformity lies between the Horton and Windsor Groups. A basal breccia 1 to 4 m thick, part of the Windsor Group, rests on the unconformity. The poorly stratified, fragment-supported basal breccia is composed predominantly of angular to subangular felsite volcanic and plutonic fragments, which appear to have been derived from Keppoch Formation and Ohio Pluton, in a granular calcareous matrix. The basal breccia is conformably overlain by bedded, detrital Windsor Group limestone. Sedimentation of the Horton and Windsor Groups took place in a large basin being formed in a transpressional environment (Keppie, 1982; Ryan, pers. comm., 1988).

MINERAL POTENTIAL:

Throughout Nova Scotia the Windsor-Horton unconformity hosts a number of economic lead, zinc and barite deposits and, so far, subeconomic but widespread copper occurrences. Of these there are a number of copper occurrences with

lesser zinc and lead in the Cross Roads - Ohio area. Disseminated copper, lead and zinc mineralization is also found in overlying limestone in outcrop and in diamond-drill holes above the basal Windsor unconformity and in reefal limestone developments basinward.

RESULTS OF 1988 FIELD CHECK: (Northcote and Armitage)

Geologic description:

Approximately 2 m of breccia are in contact on the south with the Ohio Pluton. The breccia is overlain on the north by Windsor Group limestone. Although the breccia and limestone are at the approximate position of the basal Windsor breccia there is no assurance that it marks the unconformity in this case and it is not of tectonic origin.

The granitic rock of the Ohio Pluton is fine to medium-grained, shades of pink, and is also abundantly sericitic suggesting hydrothermal alteration. The breccia is composed of bleached, altered, leucocratic (?), granitic (Ohio Pluton) fragments in a calcareous, chloritic (?) matrix containing pods of calcite (barite?). The Windsor limestone is impure, fragmental, and is cut by calcite veinlets ranging from a fraction of a cm to several cm wide.

Mineralization:

The Ohio Pluton appears to be unmineralized but the breccia matrix contains malachite, weakly disseminated chalcopyrite and possible chalcocite (?) related copper minerals masked by chlorite and manganese stain. The limestone contains sparsely disseminated chalcopyrite with scattered clusters of chalcopyrite grains in the calcite veins.

The mineralization at Callahan Brook is similar to that at Cross Roads - Ohio (E08-05) but is accompanied by intense sericitic (hydrothermal) alteration at Callahan Brook.

METALLOGENESIS:

Copper occurrences in basal Windsor breccia in the Cross Roads - Ohio area and in tectonic breccias in Keppoch Formation volcanogenic breccias at the Cross Roads - Ohio copper-zinc occurrence are accompanied by weak hydrothermal alteration. The mineralization at Callahan Brook differs from the others in that the fragments of Ohio Pluton in the breccia show strong hydrothermal sericitic alteration. Similar to other mineralized zones, large calcite crystals occur in the breccia matrix but the Ba values, which would indicate presence of barite, are low. These differences, particularly higher intensity hydrothermal sericitic alteration at Callahan Brook, compound the problem of genesis of Callahan, Cross Roads - Ohio copper-zinc and the more common Windsor breccia occurrences.

TABLE 1

PETROGRAPHY, CALLAHAN BROOK SAMPLES

88 CALL 301

Leucocratic granite(?)/granodiorite, brick red because of hematitic staining, fine- to medium-grained, sericitic alteration of abundantly scattered grains. Cleavage visible in some feldspars, << 5% scattered ragged mafic grains. Quartz conspicuous, subrounded grains.

88 CALL 302 A and C

Limestone, medium grey, mottled, whispy foliation, stylolitic. Crackled, filled with white calcite. Larger vein, filled with white calcite, mottled appearance, minor weathered siderite (ankerite) containing blebs of chalcopyrite. Iron-staining in fractures and speckled with iron-stained pits throughout.

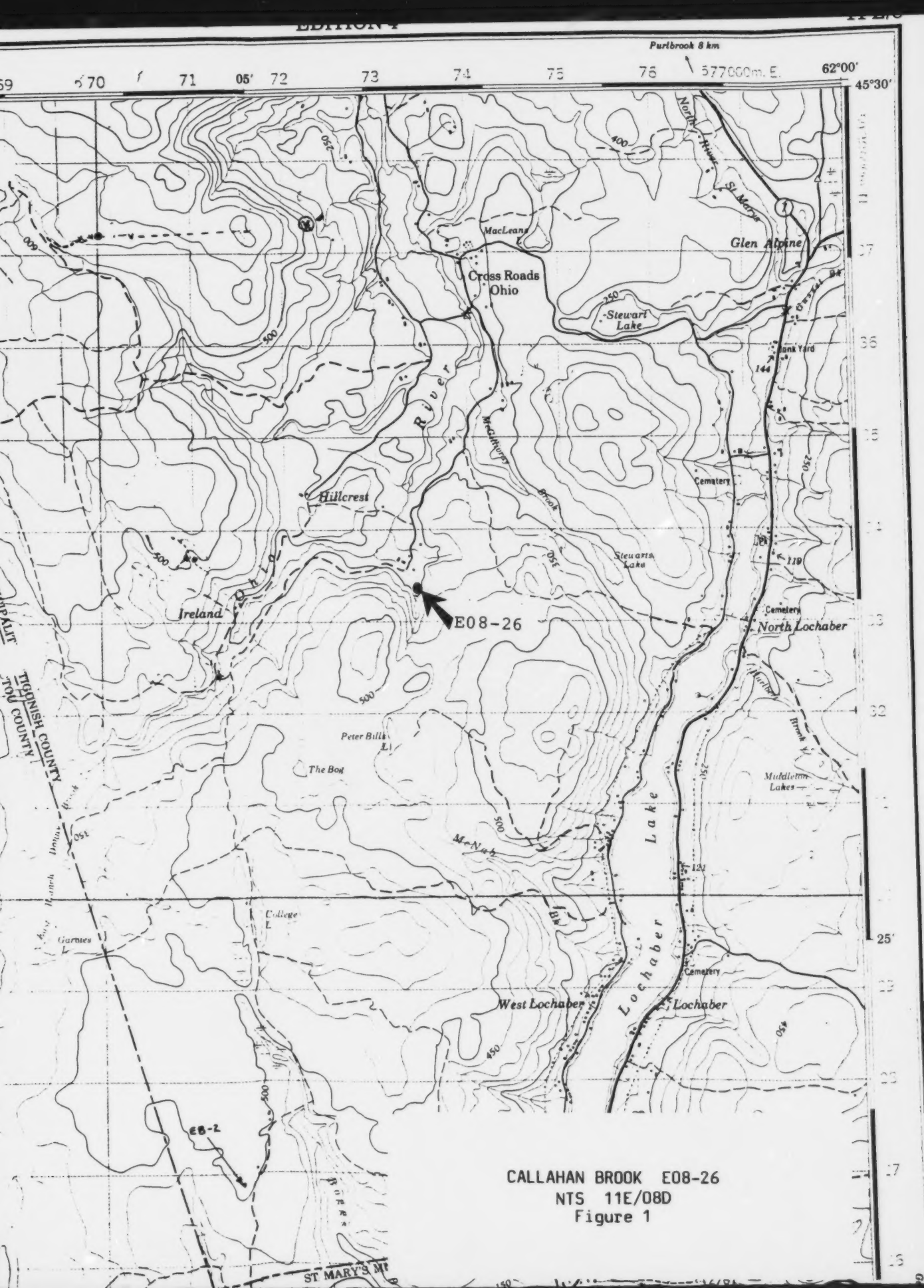
88 CALL 302 B

Altered intrusive, leucocratic, altered feldspar, conspicuous rounded quartz.

88 CALL 303 B

Breccia, angular fragments of altered leucocratic granodiorite, pale greenish-yellow alteration of feldspar to sericite and carbonate, conspicuous rounded quartz grains. Crackle brecciation with matrix infilling of medium grey clastic limy material. Black chloritic material. Weathered out vugs in breccia matrix.

Hematite and minor malachite staining in fractures, no conspicuous chalcopyrite, probable chalcocite in fractures marked by chloritic material. REQUIRES CONFIRMATION BY PETROGRAPHIC EXAMINATION OF POLISHED THIN SECTIONS.



CALLAHAN BROOK E08-26
NTS 11E/08D
Figure 1

TABLE 2
CALLAHAN BROOK ANALYSES

CALLAHAN BROOK Au + 33

88-CAL	NaX	Sc	Cr	FeX	Co	Ni	Zn	As	Se	Br	Rb	Zr	Mo	Ag	Cd	Sn	Sb	Te	Cs	Ba	La	Ce	Sm	Eu	Tb	Yb	Lu	Hf	Ta	W	Ir	Au ppb	Th	U	WT
301	1.9	4.0	220	1.3	<6	<20	<100	3.6	<5	<2	110	<200	3	<2	<5	<100	0.5	<10	2.7	390	56	70	0.3	<1	1.7	5	0.4	6	1.6	<1	<50	<2	12	2.1	33.92
303	0.00	10	140	1	20	<20	<100	80.2	<5	<2	130	450	2	<2	<5	<100	11.4	<10	3.8	780	56	10	11	<1	2.9	9	1.3	5	1	2	<50	<2	8.6	25.5	32.93

CALLAHAN BROOK ATOMIC ABSORPTION

88-CAL	Cu	Zn	Ag	Pb	Au ppb
301	2	5	0.2	<2	<5
303	522	71	1.1	8	<5

MOOSE RIVER E08-27

OCCURRENCE: MOOSE RIVER E08-27 (Iron)

LOCATION: 5036500 N 550100 E NTS 11E/08C
Reported by J.B. Murphy, 1986.

ACCESS:

From Highway 347 bridge crossing Moose River just north of Garden of Eden, drive north 4.75 km on Highway 347 to point where road branches to north (right). Follow the branch to the north for 1.5 km to bridge crossing Moose River. A tributary enters Moose River from the west at this point. The first occurrence is on the north side of this tributary about 15 m above the junction. The second part of this occurrence is on the south bank of Moose River about 20 m above the tributary junction (Figs. 1 and 2).

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC OF 1181, 2 sheets, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

GEOLOGY:

The Moose River pyritic zone is in the Moose River Member of the Keppoch Formation (Murphy, 1986). It is in close proximity to the Moose River Fault, which may have been a factor producing sulphide mineralization and the schistose fabric in the country rock.

RESULTS OF 1986 FIELD CHECK (Northcote)

Zones of hydrothermal alteration containing disseminated pyrite occur in greenish-yellow and orange-brown stained schistose tuff. Disseminated pyrite forms pods, with rough measurements of 0.5 m by 4.0 m, along foliation at stations 1 to 4, Figure 2. A similar occurrence about 20 m up the south bank of Moose River shows less intense alteration but over a broader zone with dimensions obscured by overburden.

Foliation/shear 090°/40° N

Examination of thin sections show that sulphide mineralization occurs in strongly foliated, sericitic, feldspar-quartz schistose tuff (Table 1).

Samples were analysed at Bondar Clegg Laboratories by a combination of Direct Irradiation/INAA, X-Ray Fluorescence, Atomic Absorption, D.C. Plasma, and conventional assay for a total of 10 oxides and 36 elements (Table 2). The analyses indicated nothing of economic interest. Sample 8A is weakly anomalous in Au at 11 ppb, Zr at 1433 ppm, Ga at 55 ppm, and Nb at 170 ppm.

TABLE 1

SAMPLE DESCRIPTIONS, MOOSE RIVER E08-27

86-11 MR-1 Sericitic, feldspar-quartz schistose tuff. Fine interlocking tuffaceous groundmass composed of K-spar, plagioclase, quartz. Quartz in lensoids. Sericitic alteration, whispy zones/networks along plane of foliation.

86-11-MR-2A Sericitic, quartz (feldspar) schistose tuff. Foliated sericite network, quartz lensoids, tuffaceous plagioclase groundmass. Reflected light: 10% pyrite, trace sphalerite (?).

86-11-MR-2B Sericitic, quartz (feldspar) schistose tuff. Foliated sericite network, tuffaceous groundmass, plagioclase, quartz lensoids. Reflected light: pyrite, hematite in fractures.

86-11-MR-3 Sericitic, feldspar-quartz schistose tuff. Tuffaceous groundmass, plagioclase, K-spar, quartz, lensoidal clusters of fragments. Sericite as diffuse network and stronger veinlets, both forming a weak foliation. Disseminated pyrite and hematite.

86-11-MR-4 Sericitic, quartz-plagioclase schistose tuff. Tuffaceous quartz, felted/foliated plagioclase groundmass, quartz lensoids. Sericite as diffuse foliated network. Reflected light: disseminated pyrite containing blebs of pyrrhotite, and associated with quartz, hematite, traces of sphalerite.

86-11-MR-5 Sericitic, plagioclase, K-spar, quartz, schistose tuff. Tuffaceous groundmass of plagioclase, K-spar, quartz and quartz lensoids. Diffuse foliated network of sericite. Reflected light: pyrite with scattered pyrrhotite blebs, hematite, trace of chalcopyrite, very minor sphalerite.

86-11-MR-6 Sericitic tuff. Tuffaceous groundmass of a mixture of plagioclase and K-spar in diffuse zones as indicated by stained slab. Very fine disseminated sericite and some diffuse coarser whispy segregations, scattered stronger lensoids and hairline veinlets. Discontinuous, diffuse, irregular hairline veinlets. Hematite, pyrite commonly associated with coarser segregations.

86-11-MR-7A Sericitic plagioclase crystal tuff. Sericite pseudomorphs after coarse euhedral plagioclase in a chlorite-sericite-carbonate matrix. Opaque/near opaque fibrous, acicular, anhedral, irregular grains.

86-11-MR-7B Sericitic plagioclase crystal tuff. Sericite pseudomorphous after coarse plagioclase. Euhedral plagioclase, anhedral quartz crystal fragments, in a weakly foliated altered matrix of carbonate, sericite, chlorite. Weak sericitic shear planes. Irregular opaques.

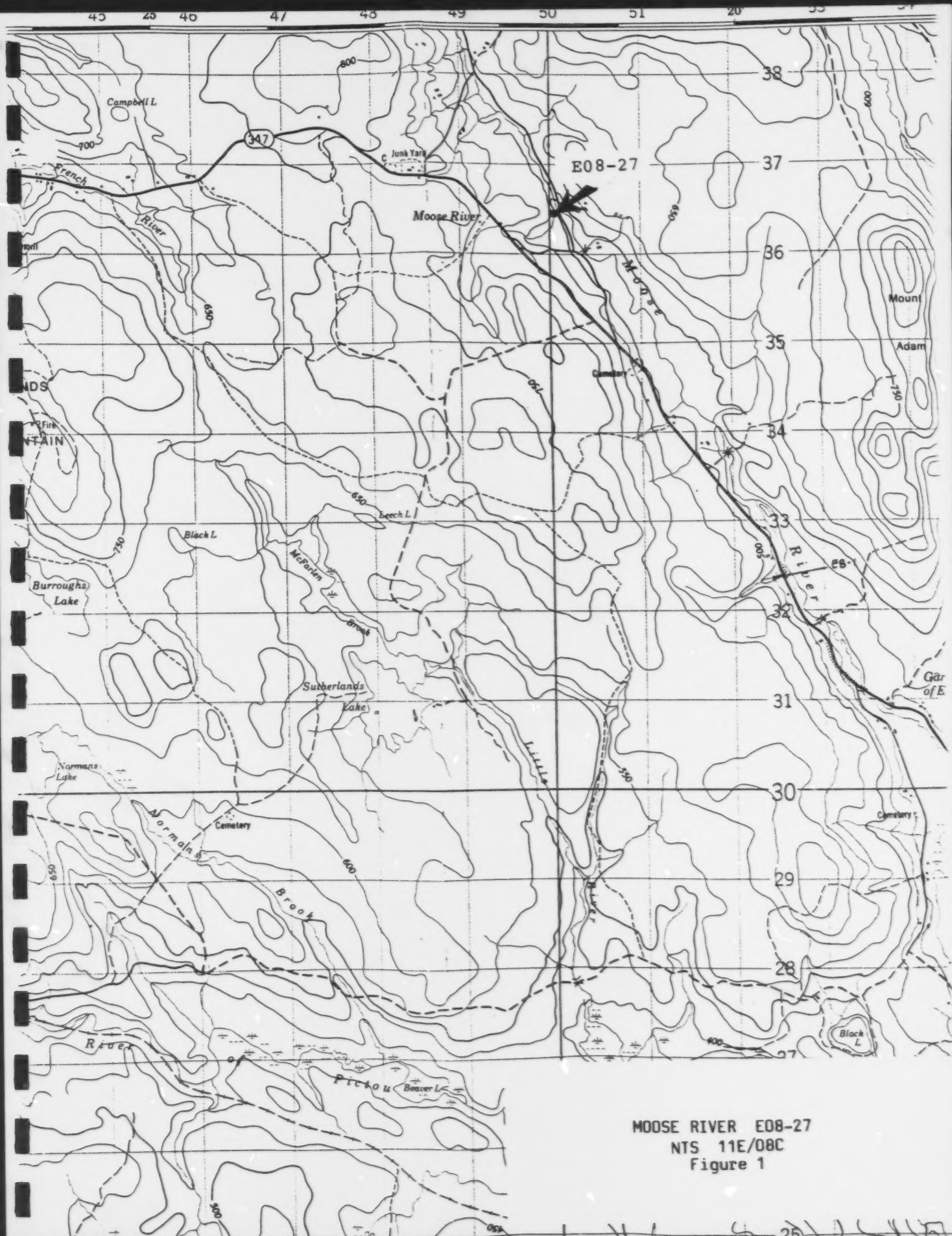
86-11-MR-8 Sericitic K-spar-plagioclase-quartz schistose tuff. Foliated whispy network in a plagioclase-K-spar-quartz groundmass. Coarser sericite segregations. Quartz lensoids and veinlets. Pyrite with hematite rims. Hematite in fractures and diffusions from fractures into foliations.

86-11-MR-8A Rhyolite. Very fine plagioclase-K-spar-quartz anhedral interlocking grains, weak preferred orientation. Chloritic (pumpellyite(?)). Cut by veinlets of quartz and chlorite (pumpellyite(?)). Trace pyrite, magnetite(?), ilmenite(?).

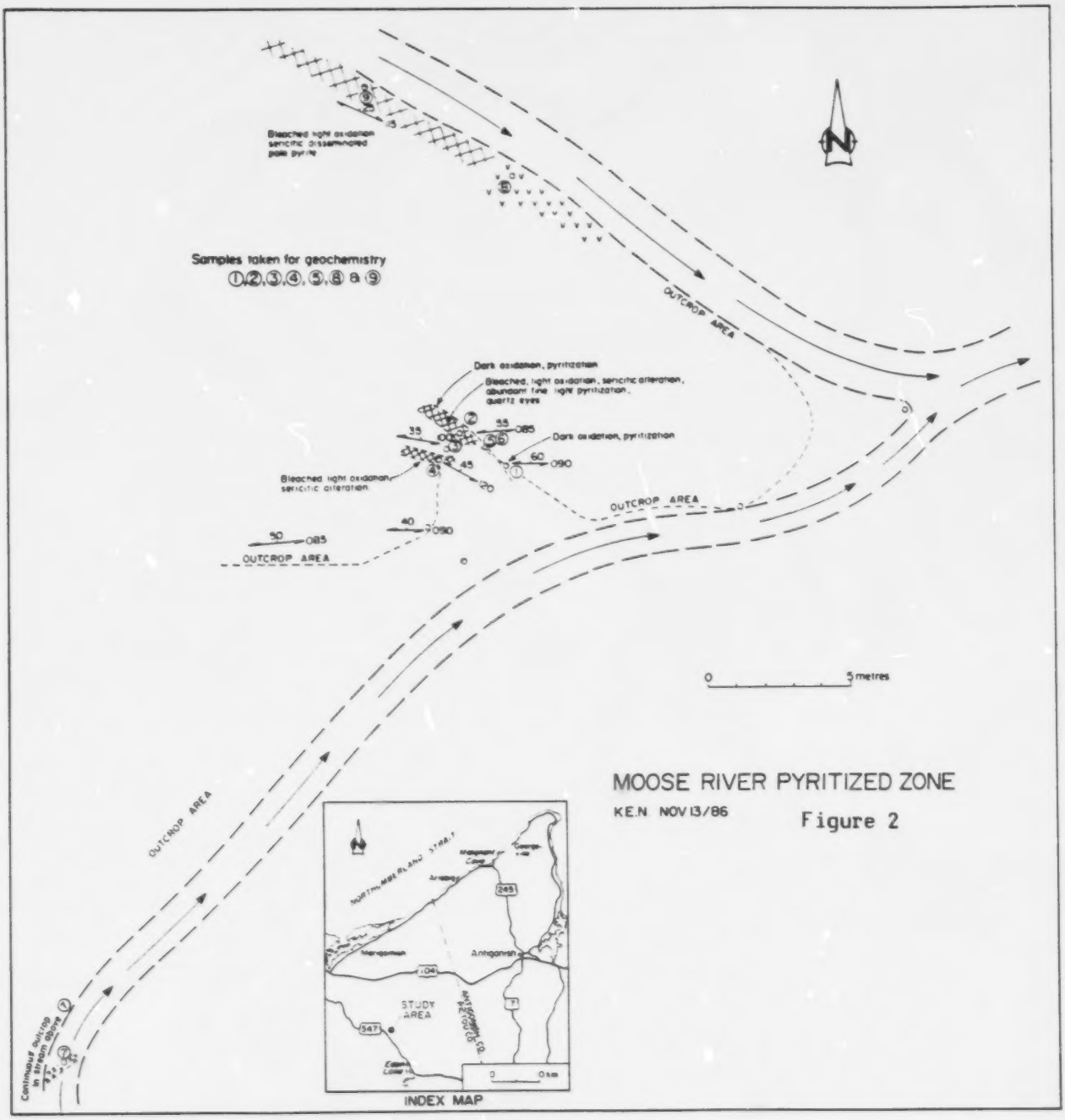
86-11-MR-9A Foliated, sericitic feldspar tuff. Scattered coarse plagioclase crystal fragments in fine grained interlocking, anhedral groundmass of plagioclase-K-spar-quartz with accessory sphene(?). Mottled by coarser patches of feldspar

and quartz segregations. Superimposed sericitic network, locally very intense. Pyrite, ilmenite, sphene(?).

86-11-MR-9B Foliated sericitic feldspar tuff. Scattered coarse plagioclase crystal fragments in a sericitic, fine grained, interlocking, anhedral groundmass of plagioclase, K-spar and quartz. Preferred orientation. Quartz segregations. Superimposed diffuse foliated network of sericite with coarser segregations. Disseminated opaques.



MOOSE RIVER E08-27
NTS 11E/08C
Figure 1



MOOSE RIVER PYRITIZED ZONE

K.E.N. NOV 13/86

Figure 2

T10

TABLE 2
MOOSE RIVER SAMPLE AN

MOOSE RIVER SILICATE ANALYSES

86-11-MR	SiO2	TiO2	Al2O3	Fe2O3*	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	Total
2	61.95	0.86	17.3	4.82	0.04	1.89	0.32	4.15	4.53	0.18	4.35	100.39
9	71.7	0.27	14.4	2.13	0.01	0.68	0.11	1.95	5.29	0.07	2.15	98.74

MOOSE RIVER ADDITIONAL ANALYSES

86-11-MR	Li	Be	Cu	Zn	Ag	Pb	Bi	F	Mo	Ba	Sr	Zr	Nb
1	14	<1	14	55	<0.5	15	<2	400	10	834	215	251	16
2	18	<1	13	29	<0.5	15	<2	730	10		159	172	6
2A	18	<1	13	29	<0.5	15	<2	920	10		154	183	6
3	20	<1	10	31	<0.5	14	<2	580	5		103	243	6
4	12	<1	15	58	<0.5	14	<2	825	15		144	157	5
5	19	<1	14	36	<0.5	10	<2	420	5		257	255	9
6	11	<1	32	45	<0.5	14	<2	350	15		70	217	12
8	7	<1	14	27	<0.5	23	<2	370	5		80	1433	17
8A	11	<1	56	44	<0.5	9	<2	500	10	852	77	220	9
9	6	<1	14	36	<0.5	25	<2						

MOOSE RIVER Au + 25

86-11-MR	Sc	Cr	Fe	Co	Ni	Zn	As	Se	Rb	Mo	Ag	Cd	Sb
1	6.2	59	3.	<50	<200	<100	6.0	<5	160	2	<2	<5	0.7
2	15	60	5.	<50	<200	120	4.0	<5	200	2	<2	<5	1.5
2A	17	79	5.	<50	<200	<100	6.1	<5	220	2	<2	<5	1.4
3	7.6	70	3.9	<50	<200	<100	.11	<5	180	6	<2	<5	0.9
4	18	59	3.9	<50	<200	<100	7.7	<5	220	4	<2	<5	1.4
5	9	70	2.8	<50	<200	<100	.15	<5	160	2	<2	<5	0.9
6	3.7	100	1.7	<50	<200	<100	3.5	<5	210	6	<2	<5	0.9
8A	3.2	110	2.1	<50	<200	<100	10	<5	90	6	<2	<5	0.7
9	3.4	100	1.6	<5	<20	110	2.8	<5	200	6	<2	<5	0.8

MOOSE RIVER ASSAYS

86-11-MR	Au oz/t	Ag oz/t
2	<0.001	<0.01
2A	<0.001	<0.01
8A	<0.001	<0.01
9	<0.001	<0.01

SAMPLE ANALYSES

Nb	Ga
16	<10
6	<10
6	26
6	<10
9	<10
12	<10
170	<10
9	<10

Sb	Cs	Ba	La	Eu	Tb	Yb	Hf	Ta	W	Ir	Au	Th	U	Wt
0.7	4	1500	16	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.7
1.0	4	850	15	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.7	4	1100	10	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.8	4	1500	27	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.7	4	710	10	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.8	4	1500	29	<2	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.7	4	980	24	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.7	4	650	59	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6
0.7	4	970	17	<1	0.8	4	6	0.9	<1	<50	<2	4	4	9.6

TOZER ROAD

OCCURRENCE: TOZER ROAD E08-29 (Pyrite)

LOCATION: 5037200 N 570000 E NTS 11E/08D

ACCESS:

Leave Trans-Canada Highway 104 at James River overpass and drive south 0.8 km to Beaver Meadow turnoff. Turn right and drive 0.4 km and cross bridge over Hartshorn Brook. Turn south (left) at the west end of the bridge and drive 3 km south past the east side of Camerons Lakes to road junction entering from northeast (left). Continue driving south for another 4 1/2 km past Donny Brook road junction taking the southeasterly branch for another 2 km to Tozer Road. Drive easterly on Tozer Road for 1/3 km to the first of several pyritic zones which extend easterly intermittently for 0.5 km.

REFERENCES:

Murphy, J. B. (compiler), 1986. Geology of Central and Southern Antigonish Highlands. Geological Map, Geological Survey of Canada, Sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D., Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

TECTONIC SETTING:

The following discussion of tectonic setting is taken from Murphy et al., in press.

The Keppoch Formation, of late Precambrian age, comprises approximately 3000 m of bimodal volcanic or volcanic-derived rocks which are subaerial (Fraser Brook Member) at the base and submarine (Moose River) toward the top. The felsic Frasers Brook rocks range from coarse, light grey, pink or red, volcanic breccia and agglomerate with a few flows, likely extruded close to vents, grading outwards into ignimbrite, and distal medium to fine-grained tuff and lahar. Interbedded basic rocks are composed of basalt and basaltic-andesite. The Moose River Member contains green volcanic pyroclastic rock with greywacke and dark porcellaneous, finely laminated mudstone.

The felsic rocks appear to have resulted from anatexis of the crust by rising magma. The interlayered basaltic andesite and basalt, derived from the mafic magma, are of two types: continental aphyric tholeiitic, and porphyritic calc-alkalic. The mudstone and greywacke are inferred to have been deposited by turbidity currents in a marine environment. The Keppoch Formation rocks are thought to have been formed in a rifted volcanic arc environment.

MINERAL POTENTIAL:

Similar tectonic environments elsewhere host economic mineral deposits both in the subaerial and submarine environments. There are worldwide examples of subaerial, felsic, volcanogenic, hydrothermal base and precious metal deposits with subvolcanic, comagmatic porphyry-related orebodies. Submarine, bimodal volcanism and sedimentation, on the other hand, may be accompanied by deposition of bedded volcanogenic, multi-element, massive sulphides such as Kuroko type polymetallic sulphide and precious metal deposits.

The subaerial felsic rocks of the Keppoch Formation host mineral occurrences ranging from broad pyritic zones in distal volcanogenic units to Cu-Zn-Pb-Ag mineralization hosted in secondarily brecciated felsic, lithic, tuffaceous breccia at Cross Roads - Ohio.

GEOLOGIC SETTING:

Broad but discontinuous pyritic zones occur 0.3 km east of the junction of Tozer and Keppoch Mountain roads. They extend approximately 2 km along strike north and south of the road and about 0.4 km easterly across strike (Murphy et al., in press; Figs. 1 and 2 of this report).

RESULTS OF 1986 FIELD CHECK: (Northcote)

Lithology:

Examination of hand specimens and polished thin sections shows mineralization is hosted by felsic, lithic tuffaceous breccia, ignimbrite, flows and basaltic andesite of the Frasers Brook Member of the Keppoch Formation. The felsic lithic tuffs contain polymictic volcanic fragments showing a variety of textures and colours (pink, red hematitic or pale grey). The lithic fragments are commonly tuffaceous but plagioclase porphyritic felsites are also abundant and both show wide variation in modal K-feldspar, quartz, and hematite content. The tuffaceous matrix is quartzofeldspathic aphanitic with broken quartz and feldspar crystals and minute lithic fragments. Mafic minerals have been altered to chlorite.

The plagioclase groundmass in flows may have a fine felted or flow layered plagioclase fabric. Some flows contain phenocrysts of plagioclase and partly resorbed (corroded) quartz in an aphanitic matrix. Samples from adjacent flows contain varied amounts of interstitial K-spar.

The ignimbrite is of similar composition to the lithic tuff, contains similar polymictic lithic clasts and crystal fragments, but shows eutaxitic foliation resulting from flattened welded pumice or devitrified glass(?).

Basaltic andesite may have a flow aligned or felted groundmass of plagioclase with varied amounts of pyroxene (augite?). Coarser plagioclase phenocrysts in the groundmass give a porphyritic texture.

Alteration:

All of the felsic rocks show similar, predominating, sericitic alteration of feldspars with lesser chlorite which has probably replaced mafic minerals in the matrices. Quartz forms small diffuse impregnations and veinlets, commonly with epidote or chlorite which also form their own separate veinlets. Alteration is intense locally where feldspar has been completely replaced by sericite, mafic minerals by chlorite, and primary textures have been obliterated. Saussuritic (chlorite-epidote-carbonate-albite) alteration predominates in basaltic andesite although some quartz impregnations and veinlets are also conspicuous.

Mineralization:

Polished thin sections of highly pyritic samples of the volcanic rocks show significant amounts of chalcopyrite and sphalerite occurring with abundant (5 to 15%) disseminated pyrite. In felsic lithic tuff, the abundance of disseminated mineralization is varied in adjacent lithic fragments and within the tuffaceous matrix. Strong, coarse, sulphide mineralization fills fractures locally. A summary of the petrographic characteristics of the Tozer Road occurrence is given in Table 3.

Suggested Genesis of Mineralization:

Zones of intense sericitic alteration accompanied by strong disseminated pyritization with no apparent late structural control suggest volcanogenic hydrothermal centres were the origin of the sulphides. However, some of the sulphides in felsic lithic tuff, as indicated by their varied abundance in adjacent lithic fragments and broken appearance within the tuffaceous matrix, may be fragmental having originated in earlier volcanic horizons which were subsequently broken up during continuing volcanism and were redeposited.

Veinlets of sulphides cutting through the felsic rocks, although later than disseminated and fragmental mineralization, probably represent remobilized sulphides from the same volcanogenic sources.

ANALYSES:

A suite of 19 samples was analyzed for a total of 46 elements and 10 oxides using a combination of Direct Irradiation/INAA, Atomic Absorption, D.C. Plasma, X-ray Fluorescence, and conventional assay at Bondar Clegg Laboratories, Ottawa. Table 1 lists the samples analyzed and gives their positions relative to the west limits of the pyritic zones (Fig. 2).

Results:

Analytical values are low, showing no values of economic significance for Cu, Pb, Zn, Ag and Au in the Tozer Road pyritic zones (Fig. 3). Samples 1 to 14 are random chips collected from various 5 m intervals and are representative of average values to be expected from these zones. Samples TR-1 to 4 are selected samples, provided by James M. Patterson of NSDME, for which analytical values are expected to be higher than average. Figure 2 shows the locations of the samples and Figure 3 graphically displays the results of the analyses. Although analyses for the elements noted above are low, along with others, including Sb, As, Ba and Co, they are significant because they show differences in concentration attributable to association with sulphides and related gangue and they are not entirely a consequence of differences in lithology. Gold was analyzed using neutron activation and fire assay-atomic absorption methods on the same samples. Both sets of analyses give subeconomic, erratic gold values, a maximum of 30 ppb, and there is little agreement between the two types of analyses. The highest Ag value is 4.5 ppm, Cu 1417 ppm, Zn 1083 ppm, and Pb 109 ppm (Fig. 3, Bar Graphs).

TABLE 1

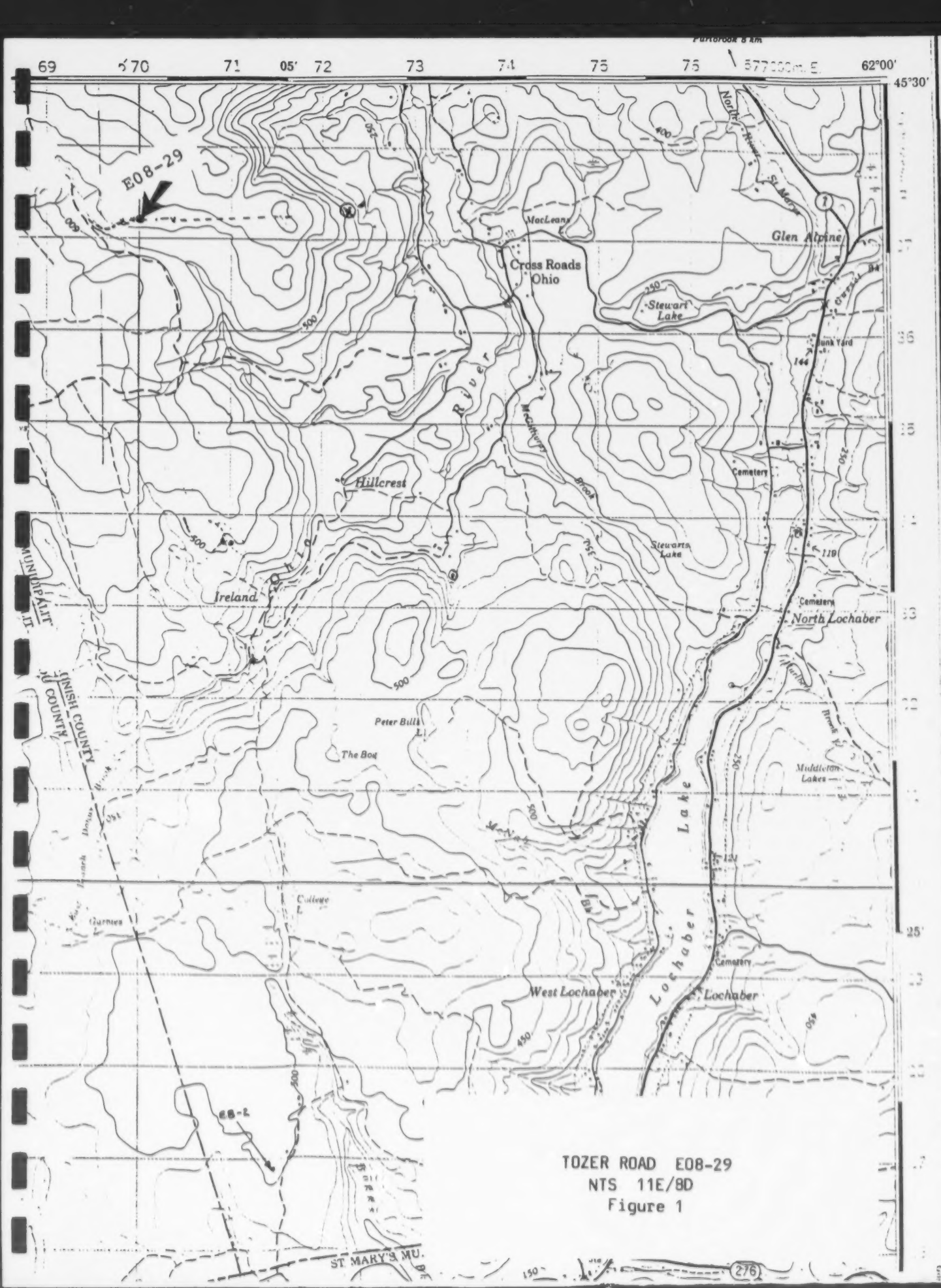
SAMPLE DATA, KEPPOCH FORMATION, TOZER ROAD

Sample Number	Interval	Lithology
86-11-KF-1	0 t 5 m E	Felsic lithic tuff
86-11-KF-2	5 to 10 m E	Felsic lithic tuff
86-11-KF-4	15 to 20 m E	Felsic lithic tuff
86-11-KF-5	20 to 25 m E	Felsic lithic tuff
86-11-KF-10	158 to 168 m E	Felsic lithic tuff
TR-3*	425 m E	Felsic lithic tuff
86-11-KF-11	190 m E	Felsic flow
86-11-KF-12	228 m E	Felsic crystal tuff
86-11-KF-13	265 m E	Fel xt lth tuff (st K-sp)
86-11-KF-13A	"	Felsic tuff (no K-sp)
86-11-KF-14	425 m E	Felsic ignimb (no K-sp)
TR-1*	425 m E	Felsite
TR-2*	425 m E	Leucogranite?
TR-4*	425 m E	Siliceous felsite
86-11-KF-3	10 to 15 m E	Intermediate flow?, dyke?
86-11-KF-6	25 to 30 m E	Intermediate flow breccia
86-11-KF-7	30 to 35 m E	Intermediate flow breccia
86-11-KF-8	35 to 50 m E	Intermediate flow breccia
86-11-KF-9	100 to 110 m E	Intermediate flow breccia

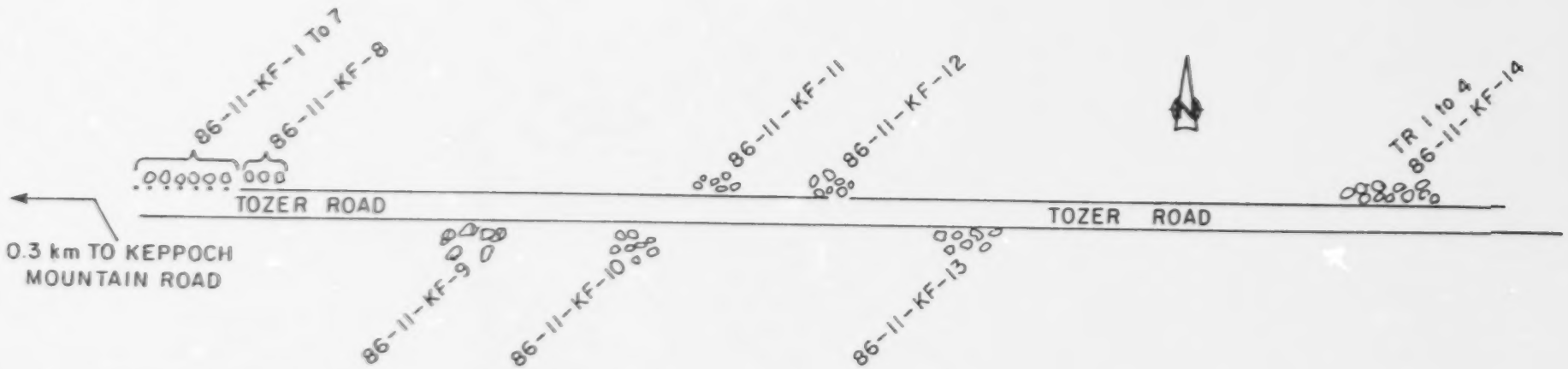
* Samples provided by James M. Patterson, NSDME.

TABLE 3
PETROGRAPHIC SUMMARY

LITHOLOGY	ALTERATION	MINERALIZATION FORM	MINERALIZATION MINERALOGY	SAMPLE NO.
TOZER ROAD Keppoch Formation				
(1) Felsic volcanogenic breccia, polymictic, hematitic K-spar rich K-spar deficient	Sericite, chlorite Veinlets, quartz, epidote, chlorite. Diffuse impregnations quartz.	Disseminated in tuff matrix, lesser in lithic fragments, blebs. Fracture fillings.	Pyrite 10 to 15%, chalcopyrite <<1% sphalerite <<1% covellite (tr) hematite pyrrhotite (tr)	KF-1, 2, 4, 5, 10, KF-12, 13, TR-3
(2) Basaltic andesite	Chlorite, epidote, sericite. Impregnations, veins quartz	Weak/moderate disseminated	Pyrite chalcopyrite (tr) hematite, magnetite (tr)	KF-3, 6, 7, 8, 9
(3) Ignimbrite, felsic welded tuff	Sericite, chlorite, quartz	Disseminated, fracture fillings.	Pyrite chalcopyrite (tr)	KF-13A, 14
(4) Felsite/rhyolite flows	Sericite, chlorite, quartz	Disseminated, fracture fillings	Pyrite chalcopyrite (tr).	KF-11, TR-1, 2, 4



TOZER ROAD EO8-29
NTS 11E/8D
Figure 1



Note: Scattered pyritic zones can be observed for approximately 2 km along strike north and south of Tozer Road

0 20 40 60 80 100
metres

Figure 2

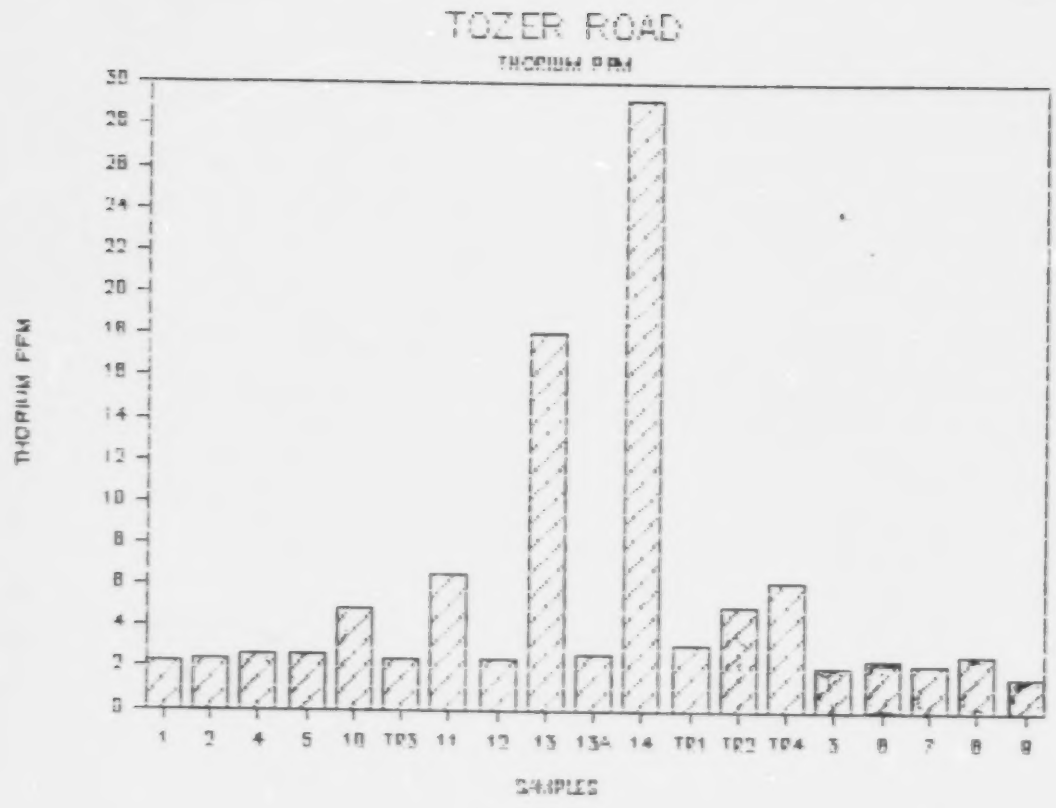
TOZER ROAD PYRITIC ZONES

KEPPOCH FORMATION

SAMPLE LOCATIONS

(Topofil and Compass Survey)

Nov. 10/'86 K.E.N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28
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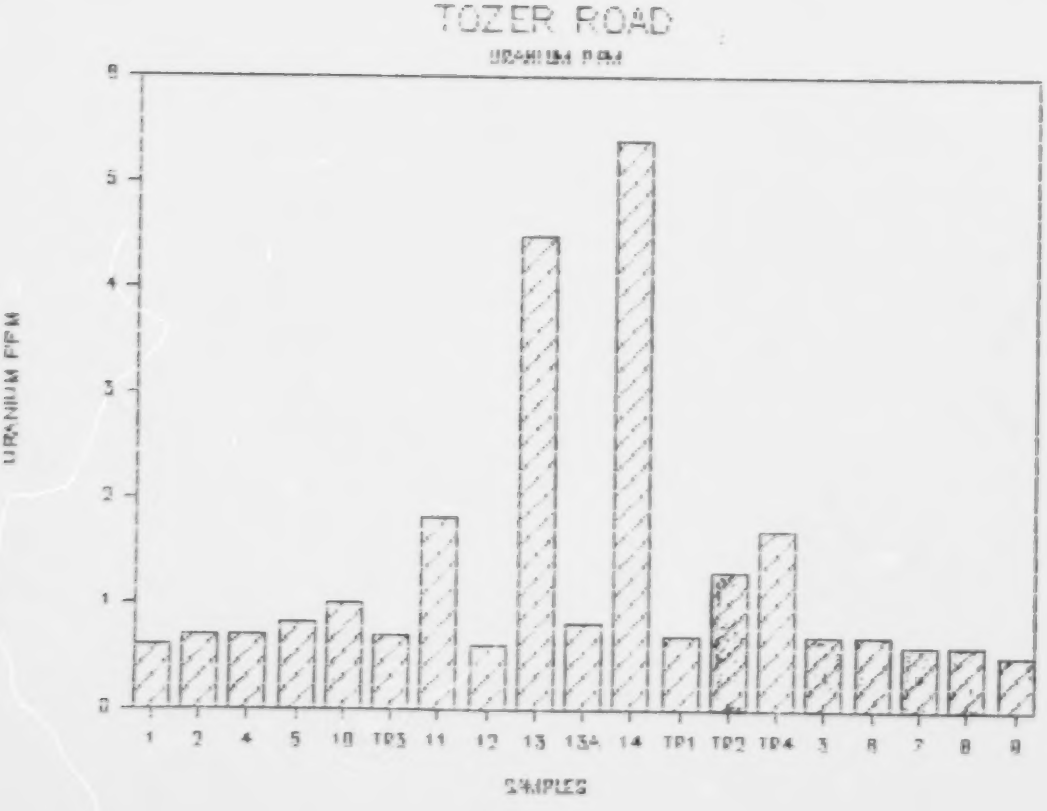
SAMPLES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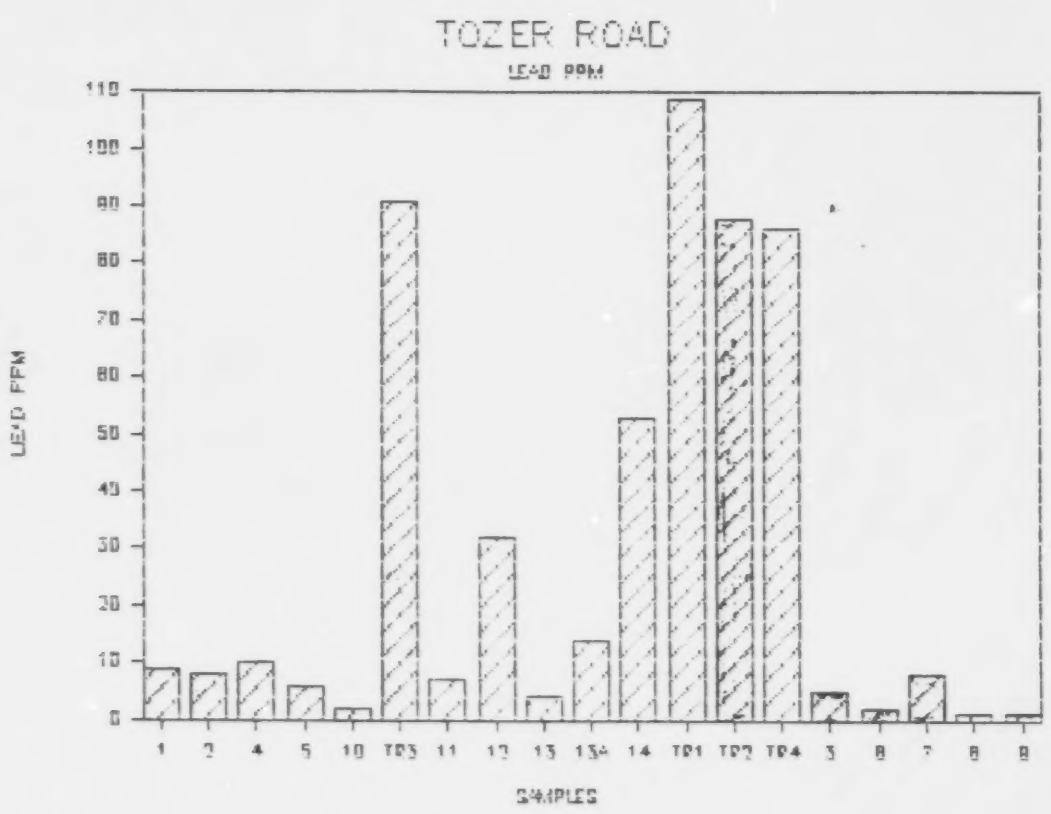
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LEAD PPM
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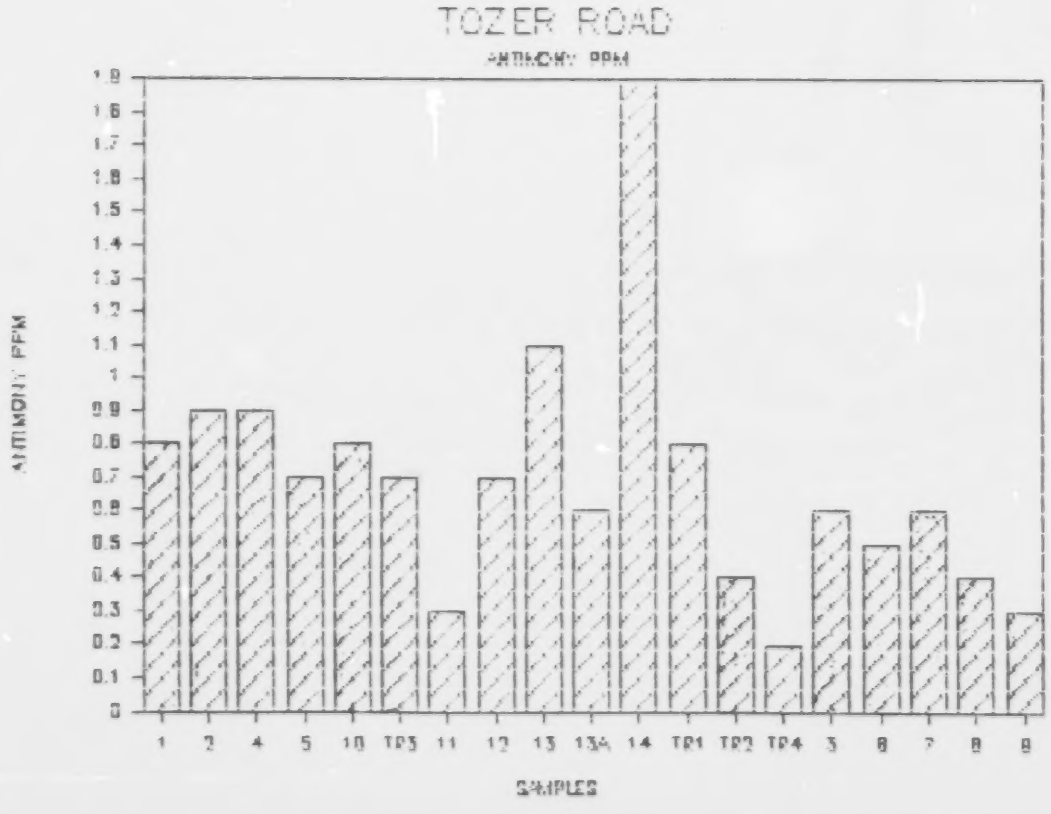
SAMPLES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1.1
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0.6
0.7
0.8
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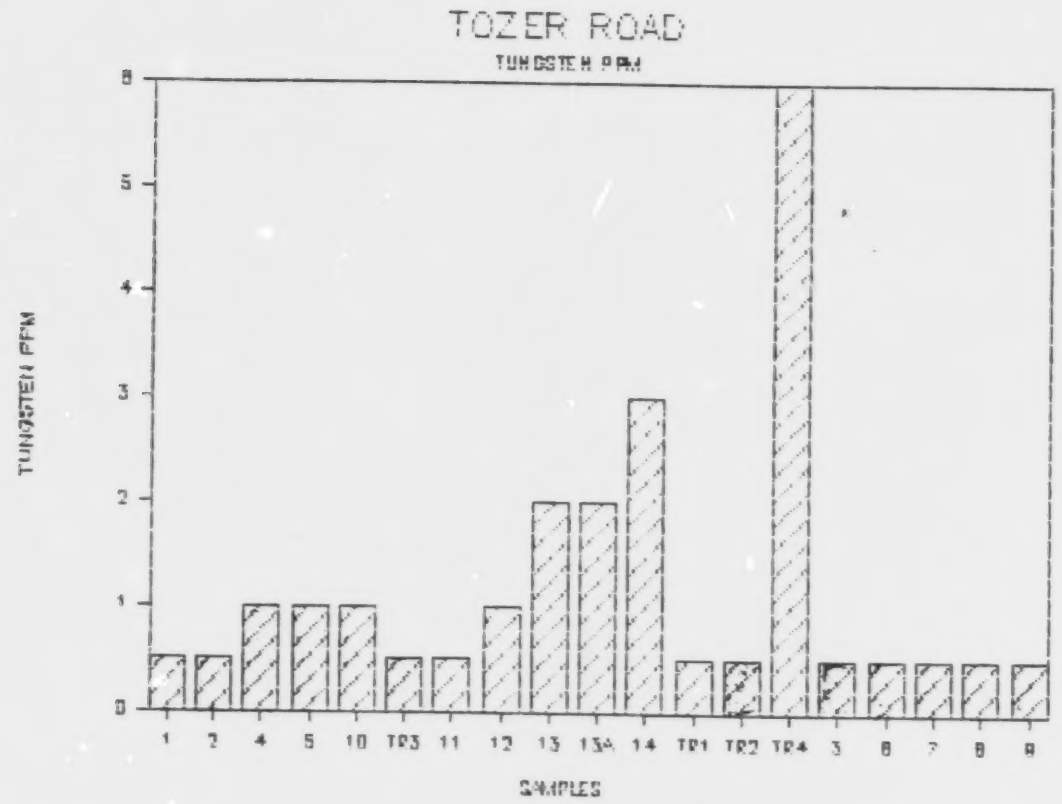
SAMPLES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TUNGSTEN PPM
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6
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12
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13A
14
TR1
TR2
TR4
3
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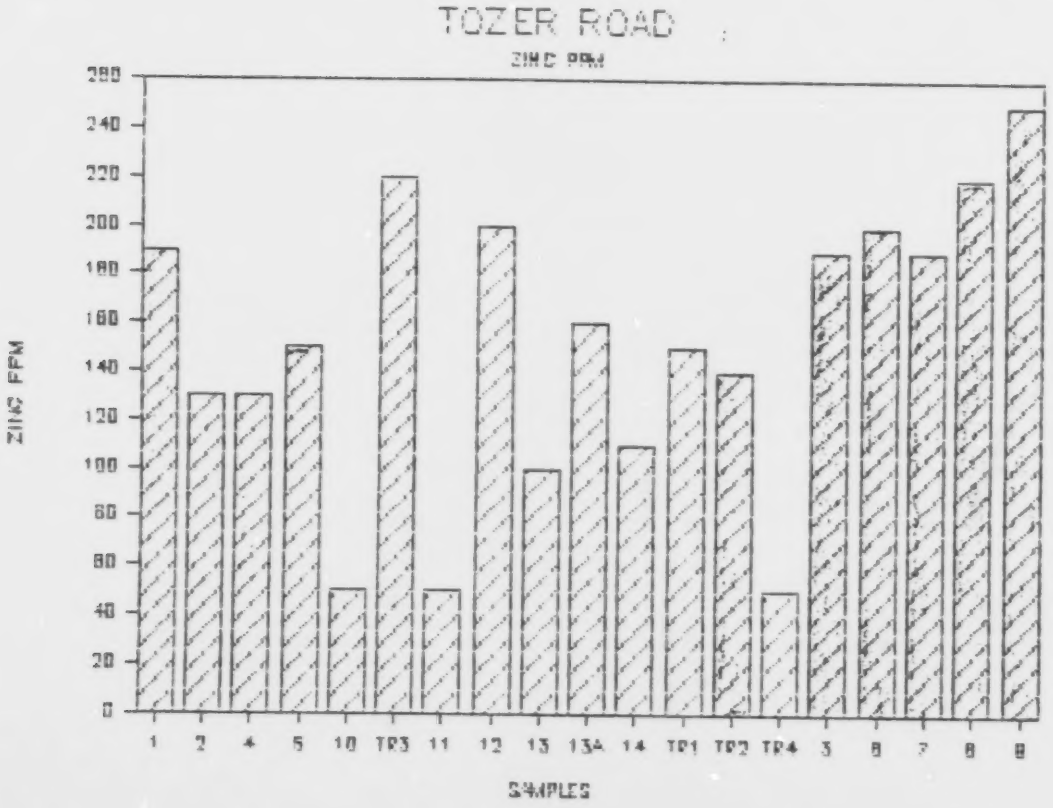
7
8
9
SAMPLES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ZINC PPM
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2
4
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TR1
TR2
TR4
3
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7
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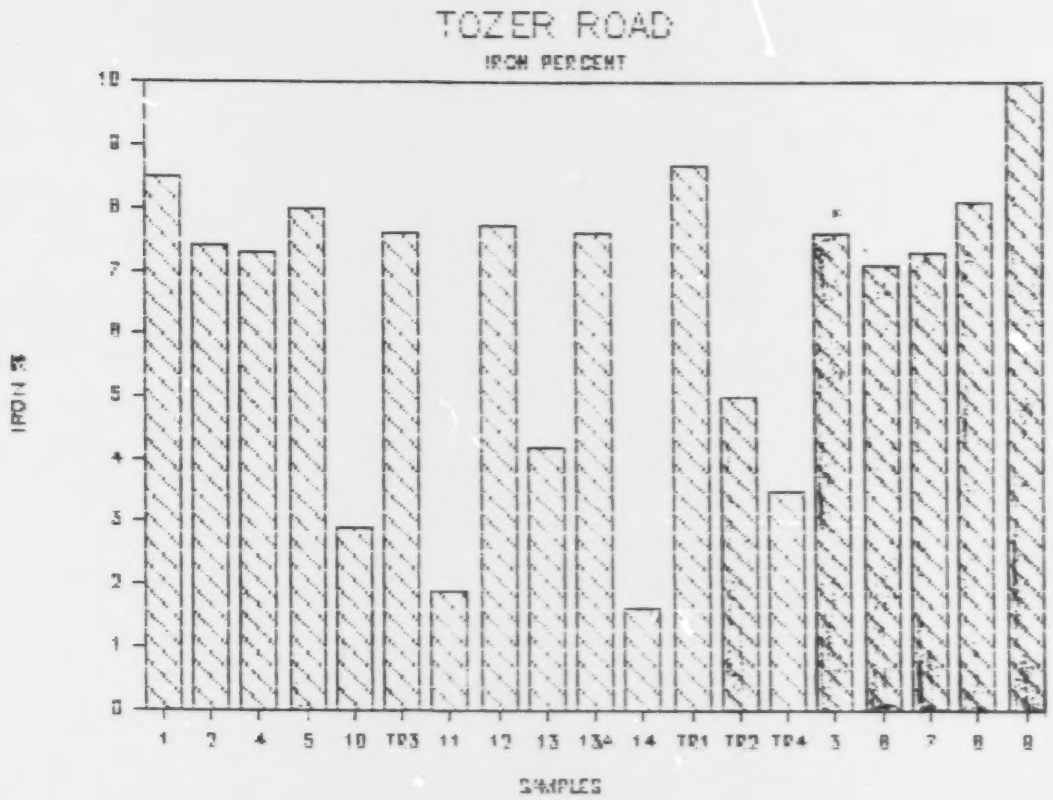
9
SAMPLES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13A
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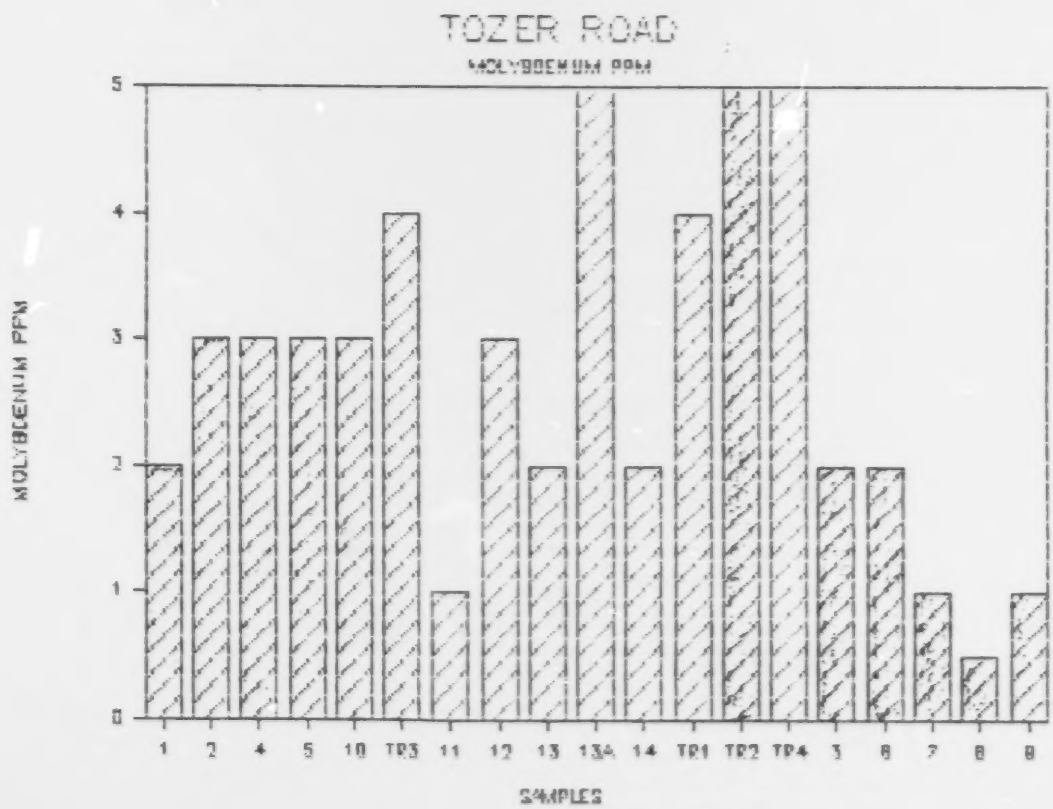
TP1
TP2
TP4
3
8
7
8
9
SAMPLES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MOLYBDENUM PPM
MOLYBDENUM PPM
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2
1
0
1
2
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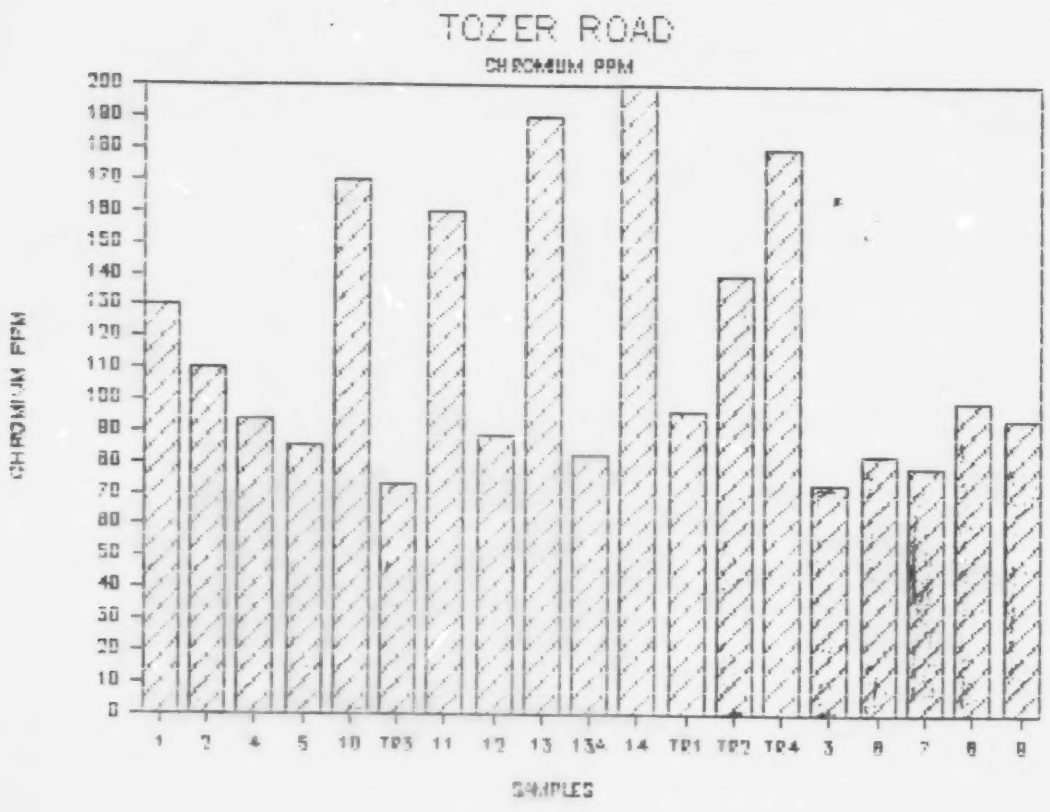
TP3
11
12
13
13A
14
TP1
TP2
TP4
3
8
7
8
9
SAMPLES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CHROMIUM PPM
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160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1
2
4
5
10
TR3
11
12
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13A
14
TR1
TR2
TR4
3
6
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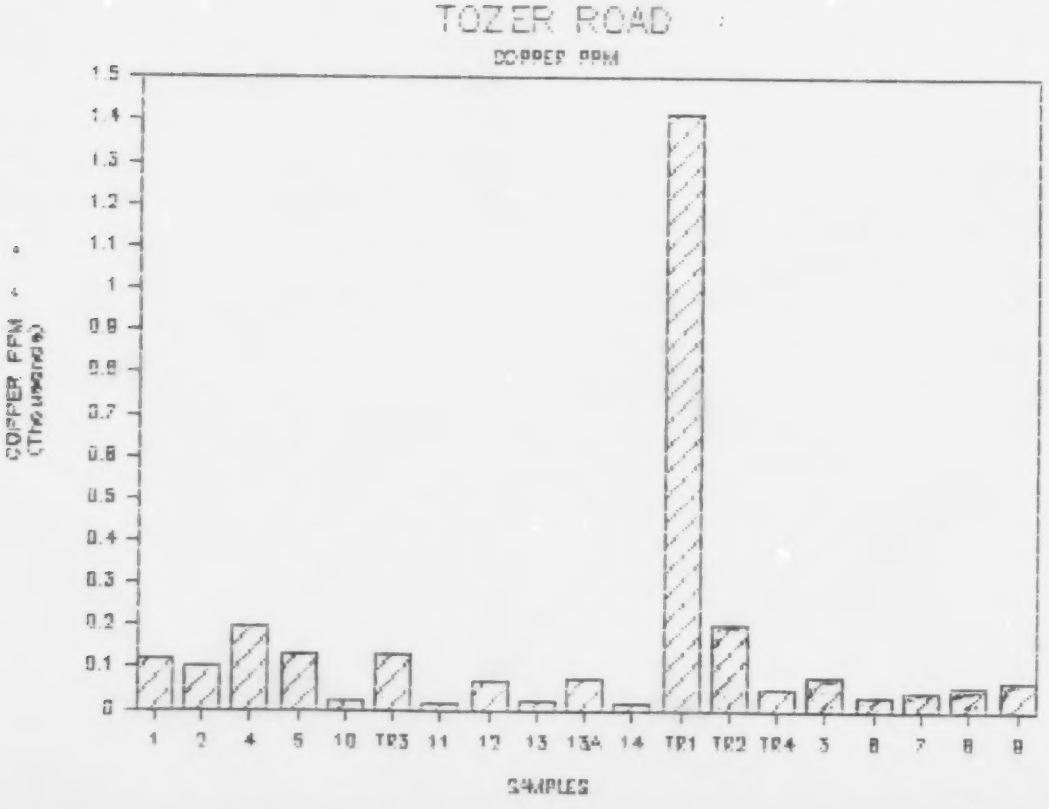
8
9
SAMPLES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COPPER PPM
COPPER PPM
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1.4
1.3
1.2
1.1
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0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
4
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TR3
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TR1
TR2
TR4
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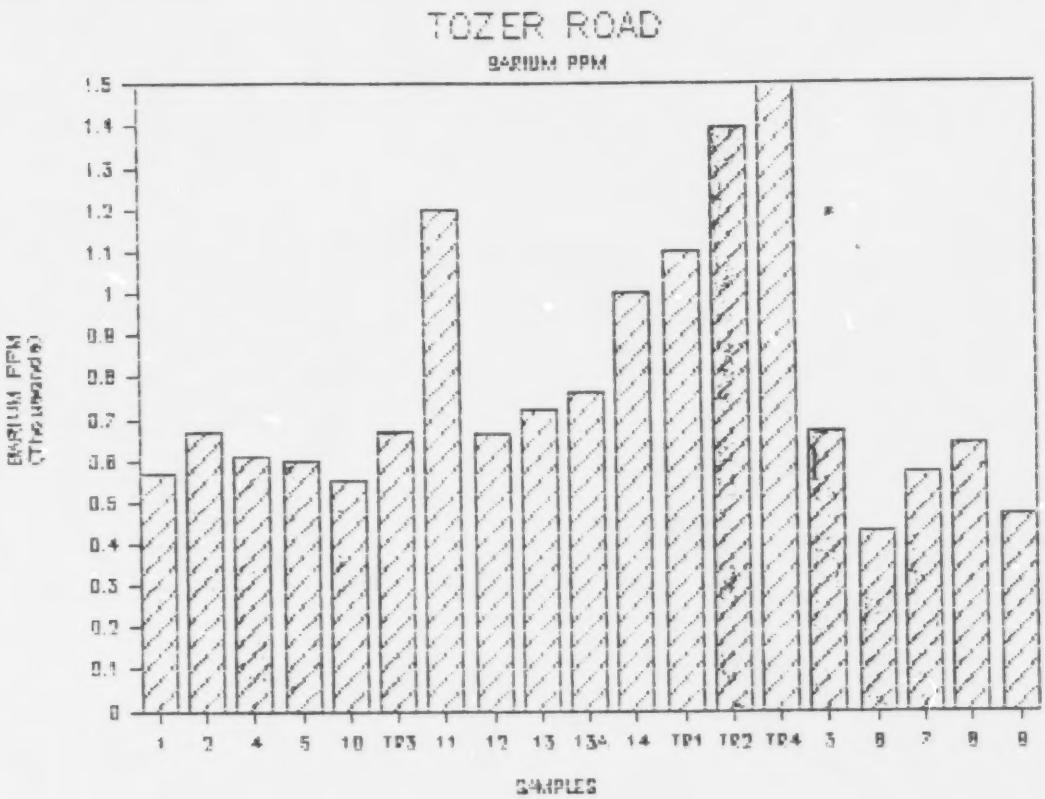
SAMPLES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1.4
1.3
1.2
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0.8
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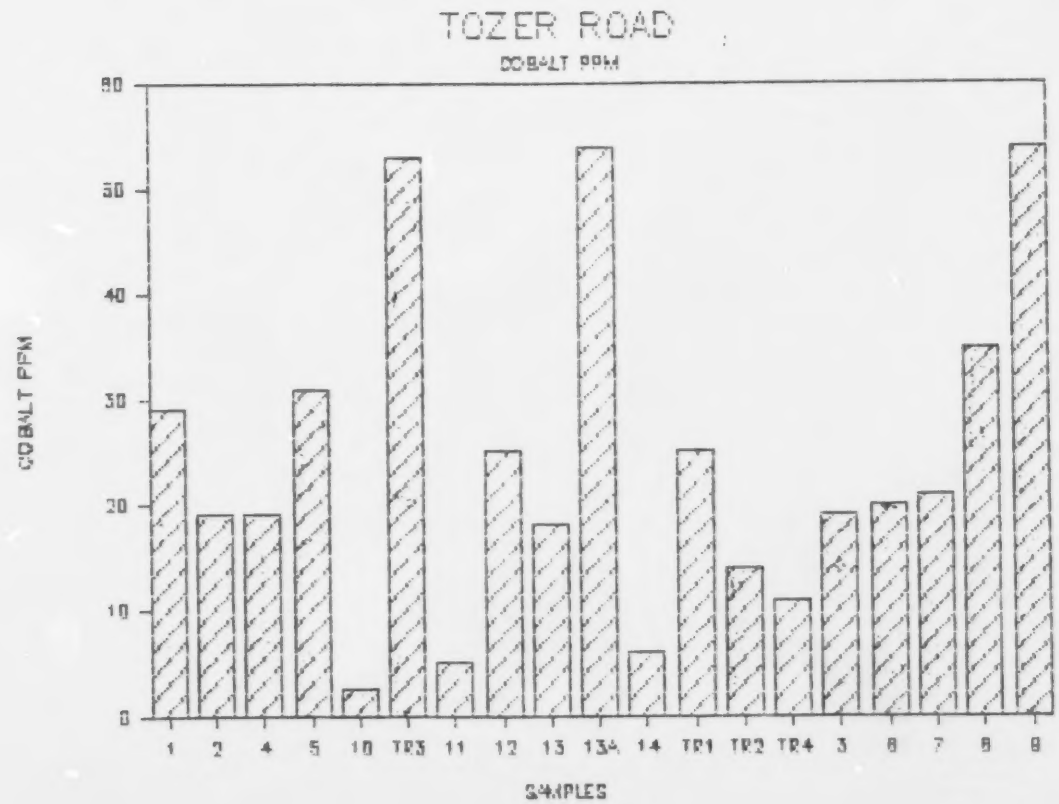
SAMPLES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30
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10
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COBALT PPM
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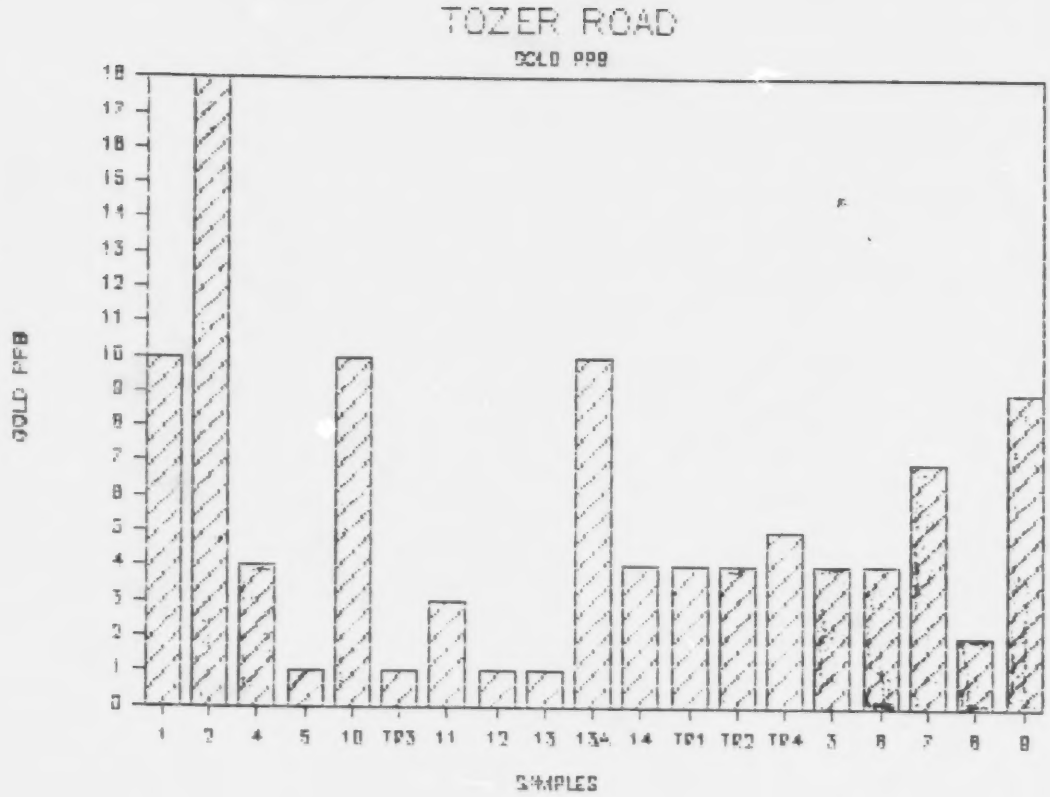
SAMPLES


TOZER ROAD
GOLD PPB
GOLD PPB
SAMPLES
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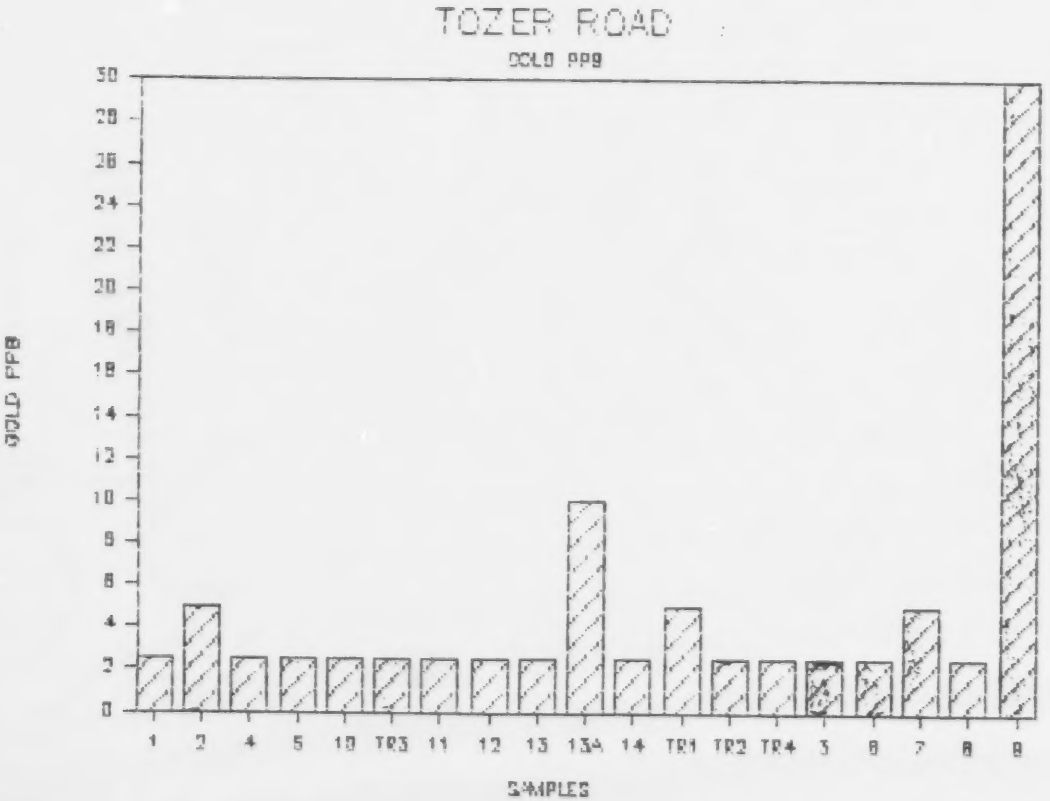
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GOLD PPB
GOLD PPB
SAMPLES
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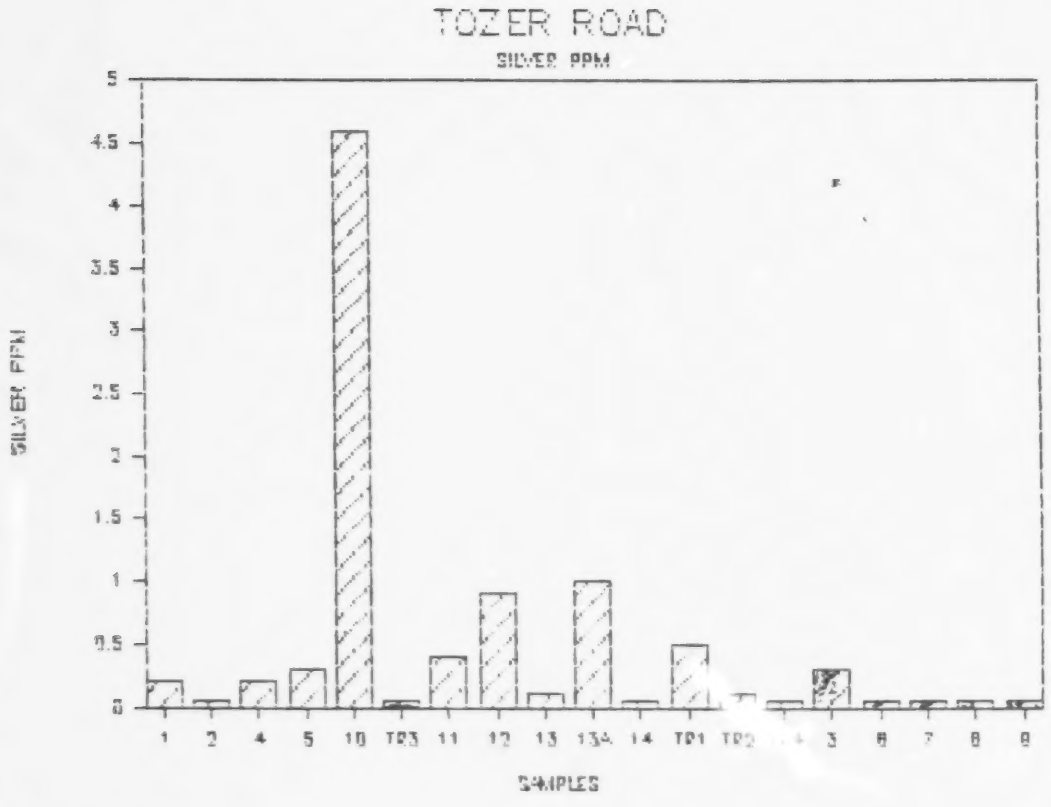
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SILVER PPM
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2
1.5
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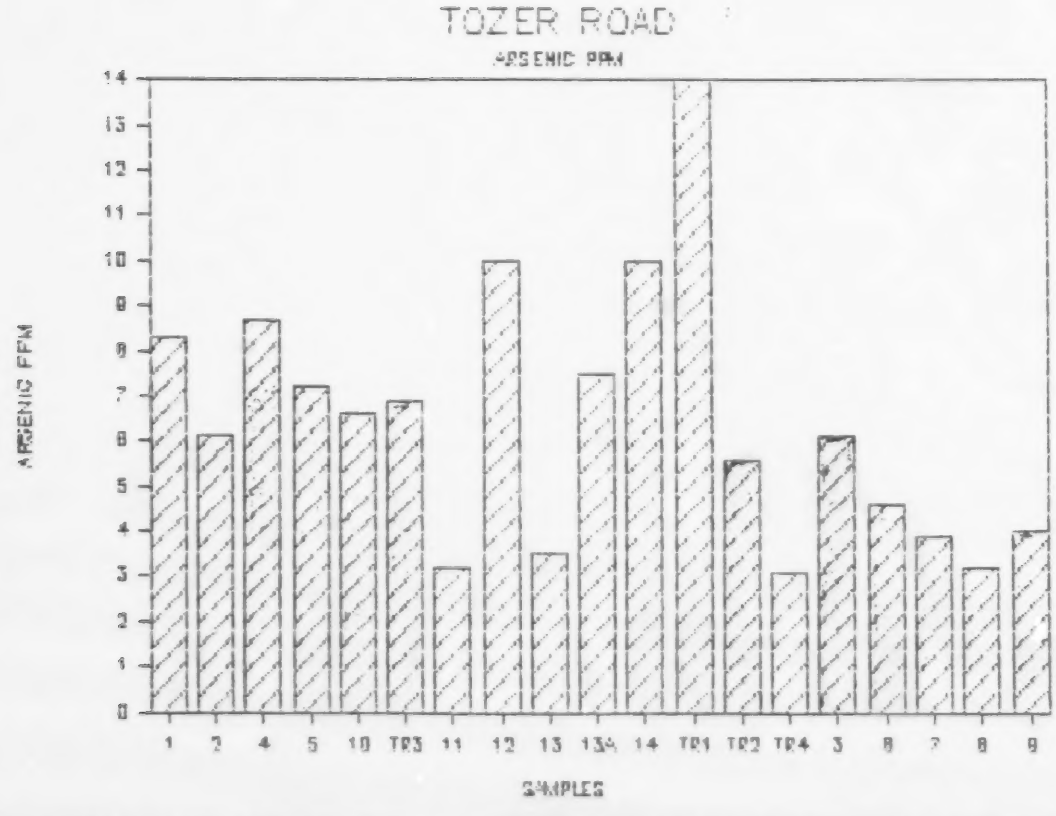
0
1 2 4 5 10 TR3 11 12 13 13A 14 TR1 TR2 TR4 3 6 7 8 9
SAMPLES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ARSENIC PPM
ARSENIC PPM
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11
10
9
8
7
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5
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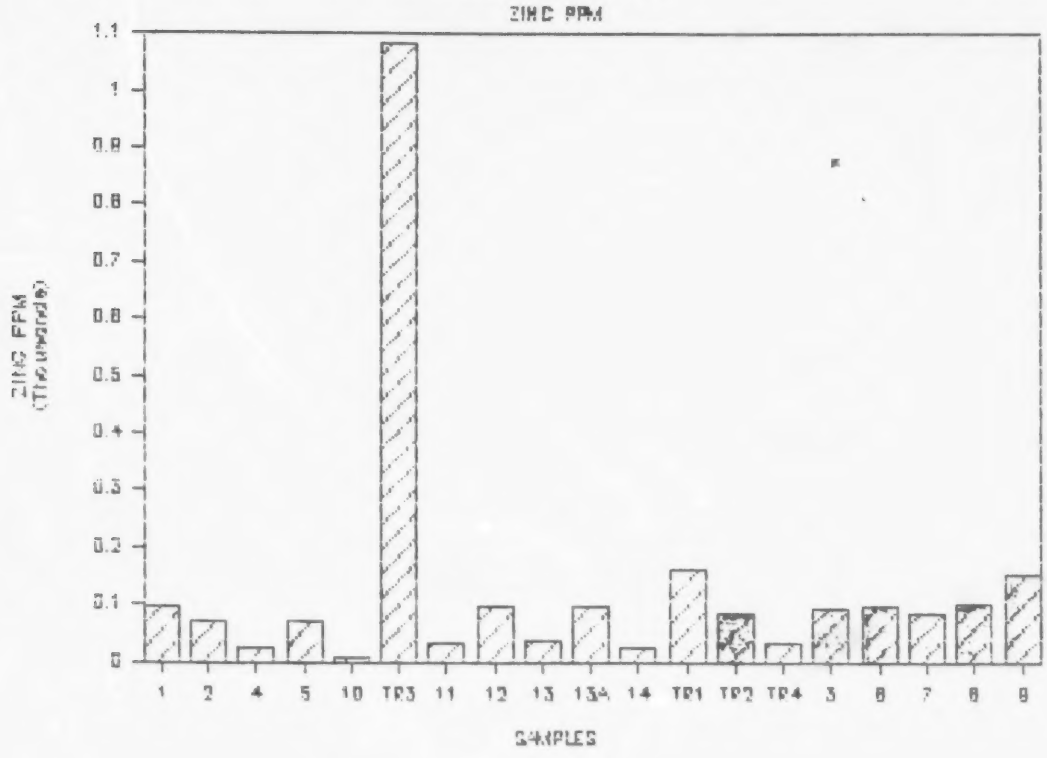
2
1
0
1 2 4 5 10 TR3 11 12 13 13A 14 TR1 TR2 TR4 3 6 7 8 9
SAMPLES

TOZER ROAD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0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
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5
10
TR3
11
12
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13A
14
TR1
TR2
TR4
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6
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8
9
SAMPLES

T11

TABLE 2
TOZER ROAD CHEMICAL A

TOZER ROAD A = 33
84-11-KF

TOZER ROAD WHOLE ROCK ANALYSES
84-11-KF

TOZER ROAD ADDITIONAL ANALYSES AND RARE EARTHS
84-11-KF

TOZER ROAD ATOMIC ABSORPTION
84-11-KF

TOZER ROAD
84-11-K

TABLE 2
WORD CHEMICAL ANALYSES

To	Yb	Lu	Th
<1	1.6	-0.2	1.9
<1	1.0	0.4	2.2
<1	1.7	0.4	2.4
<1	2.1	0.4	14.8
<1	1.0	0.2	23.5

FRASERS BROOK

OCCURRENCE: FRASERS BROOK E09-01 (Copper)

LOCATION: 5042410 N 571060 E NTS 11E/09A

ACCESS:

Located 0.6 km west of St. Joseph lake on the south branch of Frasers Brook. Follow No. 7 highway from Antigonish to Gaspereaux Lake and take the turnoff west to St. Joseph. At the junction of the roads at the brick church at St. Josephs, drive north for approximately 1 km toward Addington Forks. Take the road which branches to the south for 500 m to Frasers Brook which the road crosses at this point. Follow the south branch of the Brook for 320 m to the occurrence in Windsor Basal conglomerate which outcrops in the brook and on both sides of it. Refer to Orthophoto map, Mayfield 11E/09-T1, scale 1:10 000, (not topographic map, 11 E/09, scale 1:50 000, which appears to be in error).

REFERENCES:

Binney, W. P., 1975. Copper occurrences in Lower Carboniferous sedimentary rocks of the Maritime provinces. GSC OF 281, 156 pp.

Binney, W. P. and Kirkham, R. V., 1974. A study of copper mineralization in Mississippian rocks of Nova Scotia. GSC Paper 41-1, Part A, p. 129-130.

Binney, W. P. and Kirkham, R. V., 1975. A study of copper mineralization in Mississippian rocks of the Atlantic provinces. GSC Paper 75-1, Part A, p. 245-247.

Bourque, P. D., 1981. A metallogenic study of the Antigonish Highlands area, Nova Scotia, with special reference to the copper occurrences of the Ohio-Sylvan Glen belt. Unpublished M.Sc. Thesis, Dalhousie University, 419 pp.

Keppie, J. D., 1982. Tectonic map of the province of Nova Scotia. NSDME published map, scale 1:500 000.

Kirkham, R. V., 1978. Base metal and uranium distribution along the Windsor-Horton contact, central Cape Breton Island, Nova Scotia. GSC Paper 78-1B, p. 121-135.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highland. GSC Open File 1181, Sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

Northcote, K. E., Keppie, J. D., DeMont, G. and Murphy, J. B., 1987. Investigation of the mineral potential of the Keppoch Formation, Antigonish Highlands. *In* Mines and Minerals Branch, Report of Activities 1987, Part A, eds. J. L. Bates and D. R. MacDonald; NSDME Report 87-5, p. 143-144.

NSDME ASSESSMENT REPORTS AR 11E/09A 13 B 23 (01), (02), (03)
AR 11E/08D 07 B 33 (01)
AR 11E/09A 07 B 23 (01)

Ponsford, M. A. P., 1983. Geologic, fluid inclusion, and stable isotope study of a carbonate-hosted lead deposit at Pembroke (Glenbervie), Colchester County, Nova Scotia. Unpublished B.Sc. Thesis, Dalhousie University, 65 pp.

Ravenhurst, C. and Zentilli, M., 1987. A model for the evolution of hot (>200°C) overpressured brines under an evaporite seal: the Fundy, Magdalen Carboniferous basin of Atlantic Canada and its associated Pb-Zn-Ba deposits. *In* Sedimentary Basins and Basin-Forming Mechanisms, eds. C. Beaumont and A. J. Tankard. Canadian Society of Petroleum Geologists, Memoir 12, p. 335-349.

Smith, L. and Collins, J. A., 1984. Unconformities, sedimentary copper mineralization and thrust faulting in the Horton and Windsor Groups, Cape Breton Island and Central Nova Scotia. 9th International Congress of Carboniferous Stratigraphy and Geology, 1979. Compte Rendu, v. 3, p. 105-116.

TECTONIC ENVIRONMENT:

In the southeast Antigonish Highlands calcareous Windsor Group rocks of Carboniferous age unconformably overlie Hadrynian Keppoch felsite volcanic rocks and the Late Precambrian-Cambrian Ohio Pluton (Murphy, 1986). Basinward, the unconformity separates the Horton and Windsor Groups. A basal breccia/conglomerate, 1 to 4 m thick and part of the Windsor Group, rests on the unconformity. The poorly stratified, fragment supported basal breccia is composed predominantly of angular to subangular felsic volcanic and plutonic fragments which appear to have been derived from the Keppoch Formation and Ohio pluton. The matrix of the basal breccia/conglomerate is composed of finer lithic and crystal fragments in a calcareous groundmass. The basal breccia is conformably overlain by bedded, detrital Windsor Group limestone.

MINERAL POTENTIAL:

The basal Windsor breccia/conglomerate hosts a number of past-producing lead-zinc-silver-barite mines including Yava, Walton, Pembroke, Gays River, Smithfield, and Brookfield. Many additional mineral occurrences are known in the same horizon. The basal Windsor unconformity is, therefore, of important economic significance.

Along the Cross Roads-Ohio-James River-Antigonish basal Windsor trend the basal Windsor unconformity hosts a number of copper occurrences with lesser lead and zinc. Some disseminated copper, lead and zinc is also found in the lower Windsor limestone. Although the basal Windsor unconformity copper occurrences are numerous, none have yet supported significant production.

PREVIOUS WORK:

1952 The Frasers Brook occurrence is covered by part of the gravity and magnetometer road survey run by Nova Scotia Trade and Industry, Nova Scotia Research Foundation.

1974 NSDME AR 11E/09A 13 B 23 (01),(03) Imperial Oil.
Geological mapping.
Geochemical soil and silt survey, Cu, Pb, Zn. Geophysical ground magnetometer survey.

1974 NSDME AR 11E/09A 13 B 23 (02) Imperial Oil.
Diamond drilling (Fig. 2).
OH-5 Hole abandoned in thick sand overburden.
OH-6 Hole abandoned in thick sand overburden.

1975 NSDME AR 11E/08D 07 B 33 (01) Imperial Oil.
Airborne magnetometer survey by Kenting Earth Sciences Limited.
Ground magnetometer and gravity surveys.

1978 NSDME AR 11E/09A 07 B 23 (04) Esso Minerals Canada.
Geochemical soil survey Cu, Pb, Zn.

Figure 2 shows the location of the Imperial Oil soil and geophysical grid over the Frasers Brook occurrence.

RESULTS OF 1987 FIELD CHECK: (Northcote and DeMont)

Geology of Frasers Brook Occurrence:
The Frasers Brook occurrence is in a breccia/conglomerate at the basal Windsor Group unconformity. It is resting on Keppoch Formation volcanogenic felsic, lithic, tuffaceous breccia. The basal breccia/conglomerate is composed of fragments of Keppoch volcanogenic breccia in a calcareous matrix and is overlain by thin bedded Windsor Group limestones.

Petrography:
The underlying Keppoch Formation is composed of felsic, lithic, tuffaceous breccia containing a mix of rhyolitic and phonolitic(?) flow and felsic pyroclastic clasts in a tuffaceous matrix of crystal and lithic grains. The volcanogenic breccia shows moderately strong sericite, carbonate, chlorite and weaker silica alteration.

At Frasers Brook the basal Windsor breccia/conglomerate, of which about 2 m is exposed, differs from that at the MacIsaacs Brook and MacLean occurrences. At Frasers Brook the basal breccia clasts, although almost entirely of volcanogenic breccia, show widely scattered, smaller lithic fragments of laminated, calcareous shale. Although lithic fragments are generally angular to subangular, they are distinctly rounded in some exposures and constitute a conglomerate. The groundmass of the basal breccia/conglomerate consists of small composite lithic, and quartz and feldspar grains in a groundmass of calcareous mud.

The overlying Windsor limestone is light grey and appears to be fine fragmental with abundant shell fragments visible on fresh broken surfaces and in thin section.

Alteration:
The volcanogenic felsic breccia clasts of the basal breccia/conglomerate show similar sericite, carbonate, chlorite alteration to the underlying massive outcrops. The basal breccia groundmass shows no appreciable alteration other than recrystallized calcite and sericitic feldspar, probably inherited as fragments.

Mineralization:
The most significant mineralization at Frasers Brook occurs in the basal breccia/ conglomerate. Mineralization in the volcanogenic felsic breccia fragments of the basal breccia/conglomerate consists mainly of disseminated pyrite and occurs in hairline fractures. Grains and clusters of malachite and possible chalcocite also occur in association with, but also in the absence of, minute fractures. Mineralization at Frasers Brook, like the MacLean occurrence, is strongest in the basal breccia matrix but the mineralogy differs. The sulphide minerals include bornite with exolved chalcopyrite (?) laminations, neodigenite, covellite, and sphalerite with low iron content. The above sulphides are disseminated throughout the basal breccia matrix but are most abundant as small clusters and pods in calcite veinlets cutting the matrix with the sulphides showing preferential concentration along the margins of lithic clasts. Colloform hematite fills fractures and is commonly associated with covellite and "spotted" manganese oxide.
The overlying Windsor limestone is weakly mineralized by widely disseminated

chalcopyrite. Table 1 summarizes the petrography of the Frasers Brook occurrence.

ANALYSES: (1987 Field Check, Northcote and DeMont)

Five samples from Frasers Brook were submitted to Bondar Clegg Laboratory, Ottawa, for assay or geochemical analyses for 36 elements plus whole rock analyses. Table 2 is a list of assays and analyses from the Frasers Brook occurrence. Samples are from Keppoch volcanogenic breccia, basal Windsor breccia/conglomerate and overlying Windsor limestone. Chip samples from the basal Windsor breccia/conglomerate were taken across areas of about 1 m^2, so should give an indication of the grade to be expected. The analyses do not indicate any economic significance.

GENESIS:

The most probable model for genesis of mineralization at the Frasers Brook occurrence is one of origin of metals in Horton sediments in the Antigonish Basin, migration of metal bearing solutions, during compaction, upward and outward to the basal Windsor unconformity with deposition of copper at an oxidizing-reducing interface at the basal Windsor unconformity (Bourque, 1981; Kirkham, 1978; Ponsford, 1983; Ravenhurst and Zentilli, 1987; Smith and Collins, 1984).

AGE OF MINERALIZATION:

The age of mineralization is approximately 300 Ma for Gays River and Pembroke and copper mineralization along the Cross Roads - Ohio - James River trend is expected to be of similar age (Ravenhurst and Zentilli, 1986; Ponsford, 1983).

FRASER BROOK E09-01
NTS 11E/09A
Figure 1

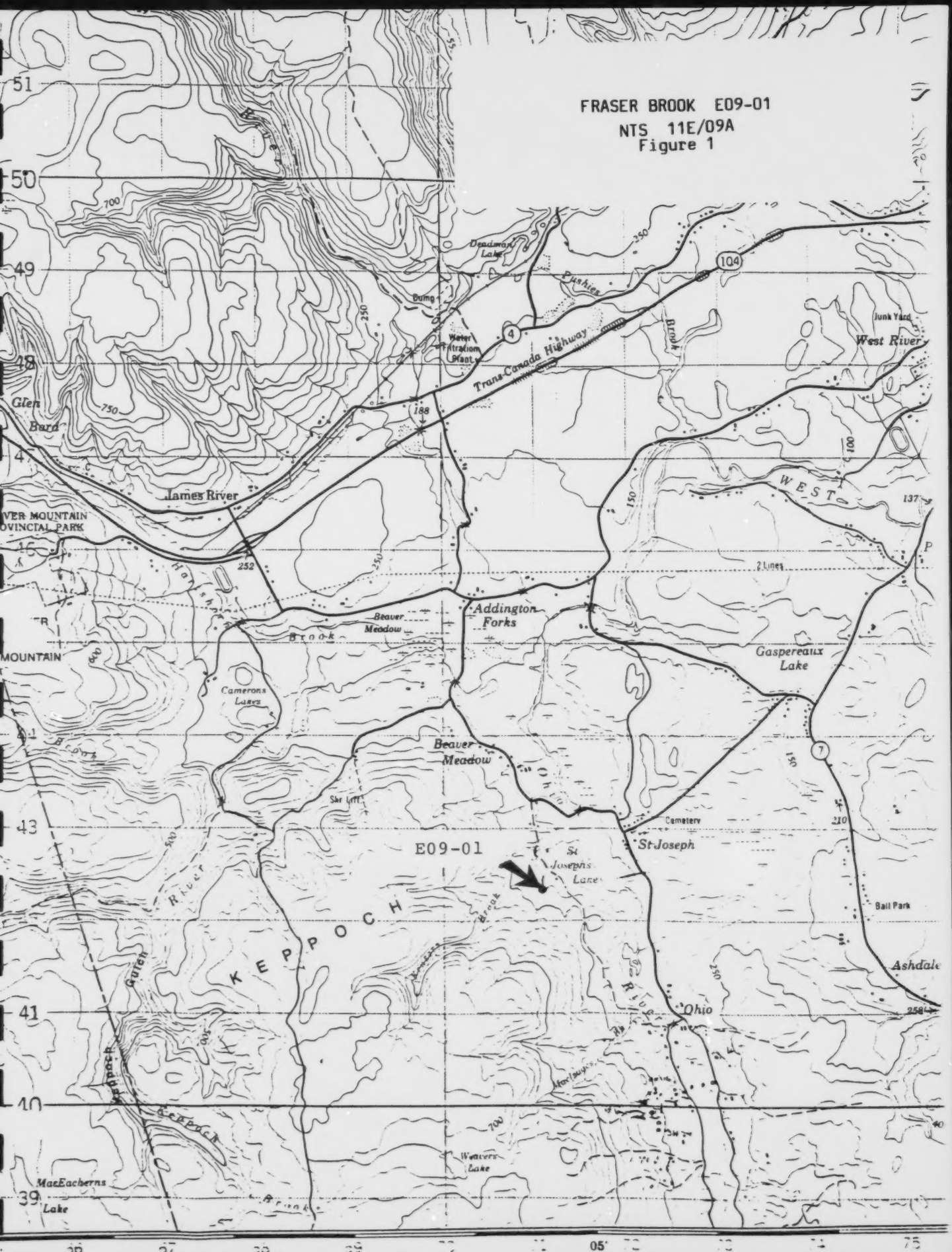


Figure 2

FRASER BROOK
GRID AND DIAMOND DRILL HOLE
LOCATIONS
NSDME AR 11E/9A 13-B023 (02)

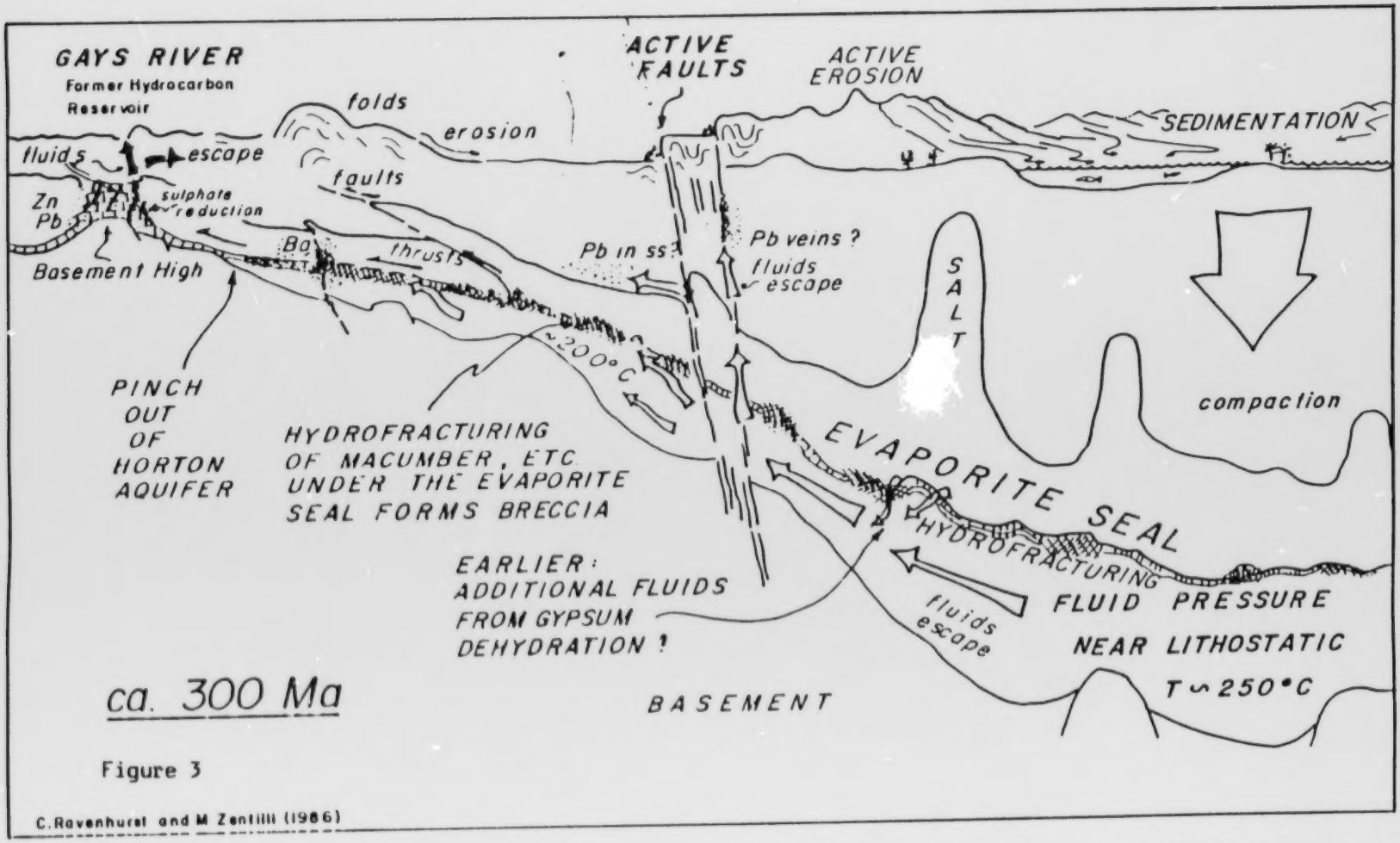


Fig. 8. The conceptual model. Overpressured fluids escape from deep in the southern part of the Magdalen Basin by a hydrofracturing mechanism. These hot, rapidly moving brines cause extensive brecciation and dissolution near the top of the aquifer — the Pembroke Breccia — under the evaporite seal. Deposits of Pb-Zn-Ba are formed at reducing sites at the margins of the basin by the hot mineralizing brines.

TABLE 1
FRASERS BROOK PETROGRAPHIC SUMMARY

	LITHOLOGY	ALTERATION	MINERALIZATION FORM	MINERALOGY	SAMPLE NO.
FRASERS BROOK					
Kappoch Formation	Outcrop and Fragmerits (1) Felsic volcanogienic breccia fragmerits and matrix	Sericite, chlorite Siliceous impregnation	Disseminated	Pyrite	8502, 8504, 8505.
Windsor Group	Calcareous Breccia Matrix (2) Fine sand textured calcareous matrix	Carbonate	Disseminated Fracture Fillings	Bornite pyrite (?) neodiginite (digenite) chalcocite	8501, 8503, 8507.
	(3) Limestone		Disseminated	Chalcopyrite	8506

T13

TABLE 2
FRASERS BROOK MAJOR AND MINOR ELEMENT ANALYSES

FRASERS BROOK: 97 COH	Au + Na(%)	Sc	V	Fe(%)	Co	Ni	Cu	Zn	Se	Ag	Cd	Sb	Te	Cs	Ba	La	Ce	Nd	Eu	Tb	Yb	Lu	Hf	Ta	W	Ir	Au(ppb)	Th	U	Mo
8301	1.7	11	71	2.2	13	31	100	1.7																				9.7	11.0	
8302	2.03	11	120	2.2	15	31	100	1.6																				9.1	10.0	
8303	1.7	11	120	2.2	15	31	100	1.6																				9.1	10.0	
8304	2.03	11	120	2.2	15	31	100	1.6																				9.1	10.0	
8305	1.7	11	120	2.2	15	31	100	1.6																				9.1	10.0	
8306	2.03	11	120	2.2	15	31	100	1.6																				9.1	10.0	
8307	2.17	11	120	2.2	15	31	100	1.6																				9.1	10.0	

FRASERS BROOK: 97 COH	WHOLE ROCK ANALYSES SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	Total %
8302	66.7	0.3	16.1	3.57	0.115	1.42	3.31	4.79	5.39	<0.01	1.73	98.31
8304	61.7	0.39	20.4	5.71	0.11	1.83	1.31	4.72	5.55	<0.01	1.83	99.37

FRASERS BROOK: 97 COH	Ti (%)	Fe (%)	S	P	Mo	Ag	V	Li	F	B	Hg(ppb)	Bi	Be
8302	0.29	1.9	6031	2357	17	426	58	14	329	1.3	<3	<1	330
8304	0.35	2	3235	284	11	35	51	12	335	1.3	<3	<1	845

FRASERS BROOK 97 COH	Cu (%)	Pb (%)	Zn (%)	Cl (%)	Ag (ppmAu	(ppb)
8302				<0.01		
8303	0.11	<0.01	0.01		0.2	<5
8304				<0.01		
8305	0.01	<0.01	<0.01		<0.1	
8306	<0.01	<0.01	<0.01		<0.1	<5
8307	<0.01	<0.01	<0.01		<0.1	<5

REIGLE

OCCURRENCE: REIGLE E09-02 (Lead-zinc-copper)

LOCATION: 5039140 N 572100 E NTS 11E/09A

ACCESS:

Drive 1.5 km south of the west end of Ohio bridge along the west side of Ohio River and go up the driveway to the old Reigle homestead (Stinson-Humpfrey). The old workings are approximately 300 m to the west, up the hill from the farmhouse. An old sloughed adit or excavation, where scattered mineralized limestone blocks are visible, is located in a small gully just above a water cistern. A number of old moss-covered pits are located in a wooded patch 100-200 m southwest of the sloughed excavation. The float that occurs in the old workings probably originated near its present location.

REFERENCES:

Binney, W. P., 1975. Copper occurrences in Lower Carboniferous sedimentary rocks of the Maritime provinces. GSC Open File 281, 1975, 156 pp.

Binney, W. P. and Kirkham, R. V., 1974. A study of copper mineralization in Mississippian rocks of Nova Scotia. GSC Paper 41-1, Part A, p. 129-130.

Binney, W. P. and Kirkham, R. V., 1975. A study of copper mineralization in Mississippian rocks of the Atlantic provinces. GSC Paper 75-1, Part A, p. 245-247.

Bourque, P. D., 1981. A metallogenic study of the Antigonish area, Nova Scotia, with special reference to the copper occurrences of the Ohio-Sylvan Glen belt. Unpublished M.Sc. Thesis, Dalhousie University, 1981, 419 pp.

Keppie, J. D., 1982. Tectonic map of the province of Nova Scotia: NSDME published map, scale 1:500 000.

Kirkham, R. V., 1978. Base metal and uranium distribution along the Windsor-Horton contact, central Cape Breton Island, Nova Scotia. GSC Paper 78-1B, p. 121-135.

Murphy, J. B., 1986. Geology of the southern and central Antigonish Highlands. Geological Survey of Canada, Open File No. 1181, Sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

Northcote, K. E., Keppie, J. D., DeMont, G., and Murphy, J. B., 1987. Investigation of the mineral potential of the Keppoch Formation, Antigonish Highlands. *In* Mines and Minerals Branch, Report of Activities 1987, Part A, eds. J. L. Bates and D. R. MacDonald; NSDME Report 87-5, p. 143-144.

NSDME ASSESSMENT REPORTS Ar 11E/09A 13 B 23 (00), (01), (02), (03),(04),
AR 11E/08D 07 B 33 (01),
AR 11E/09A 07 B 23 (01), (03), (06),

Ponsford, M. A. P., 1983. Geologic, fluid inclusion, and stable isotope study of a carbonate-hosted lead deposit at Pembroke (Glenbervie), Colchester County, Nova Scotia. Unpublished B.Sc. Thesis, Dalhousie University, 65 pp.

Ravenhurst, C. and Zentilli, M., 1987. A model for the evolution of hot (>200°C) overpressured brines under an evaporite seal: the Fundy, Magdalen Carboniferous basin of Atlantic Canada and its associated Pb-Zn-Ba deposits. *In* Sedimentary Basins and Basin-Forming Mechanisms, eds. C. Beaumont and A. J. Tankard. Canadian Society of Petroleum Geologists, Memoir 12, p. 335-349.

Smith, L. and Collins, J. A., 1984. Unconformities, sedimentary copper mineralization and thrust faulting in the Horton and Windsor Groups, Cape Breton Island and Central Nova Scotia. 9th International Congress of Carboniferous Stratigraphy and Geology, 1979. Compte Rendu, v. 3, p. 105-116.

TECTONIC ENVIRONMENT:

In the southeast Antigonish Highlands calcareous Windsor Group rocks of Carboniferous age unconformably overlie Hadrynian Keppoch felsite volcanics and the Late Precambrian - Cambrian Ohio Pluton (Murphy, 1986). Basinward, the unconformity separates the Horton from the overlying Windsor Group. A basal breccia/conglomerate 2-4 m thick, part of the Windsor Group, rests on the unconformity. The poorly stratified, fragment-supported basal breccia is composed predominantly of angular to subangular felsic volcanic and plutonic fragments which appear to have been derived from the Keppoch Formation and Ohio pluton. The matrix of the basal breccia/conglomerate is composed of fine lithic and crystal fragments in a calcareous groundmass. The basal breccia/conglomerate is conformably overlain by bedded, detrital Windsor Group limestone.

MINERAL POTENTIAL:

The basal Windsor breccia/conglomerate hosts a number of past-producing lead-zinc-silver-barite mines including Yava, Walton, Pembroke, Gays River, Brookfield and Smithfield. Many additional copper and lead-zinc-silver-barite mineral occurrences are known in the same horizon. The basal Windsor unconformity is, therefore, of important economic significance.

The Cross Roads-Ohio-James River-Antigonish trend of basal Windsor breccia/conglomerate hosts a number of copper occurrences with lesser lead and zinc. Some disseminated copper, lead and zinc mineralization is also found in the lower Windsor limestone. Although copper occurrences at the basal Windsor unconformity are numerous, none have yet supported significant production.

The basal Windsor Group limestones are mineralized at a number of localities along the Cross Roads-Ohio-James River-Antigonish trend. The possibility of significant basinward zoned Mississippi Valley type reefal development of the Lower Windsor limestone and basal Windsor conglomerate basinward from known copper occurrences was the object of diamond drilling exploration by Imperial Oil Limited and Curvier Mines Limited. A number of drillholes proved significant developments of suitable limestone and basal conglomerate host and two holes, (OH-15 and 16), showed significant lead zinc mineralization.

MINERALIZATION:

The most significant mineralization at Reigle is galena and lesser chalcopyrite in small stockworks of vuggy calcite veinlets in brecciated Windsor Group limestone float which apparently occurs just above the Windsor-Keppoch unconformity. To the southwest, below the unconformity, there is a series of old moss covered pits which contain fragments of abundantly pyritized (to 15%) Keppoch Formation volcanogenic breccia float.

PREVIOUS WORK:

1952 Part of a regional proton magnetometer, total gravity road survey.

1966 Kennco Explorations Canada Limited, DDH #3 south of Reigle.

1973-4 NSDME AR 11E/08D 07-B-33 (01) Imperial Oil Limited.
Reported February 21, 1975. Airborne magnetometer survey by Kenting Earth Sciences Limited.

1974 NSDME AR 11E/09A 13-B-23 (01) Imperial Oil Limited.
Geological, geochemical soil, silt (Cu, Pb, Zn) and geophysical proton magnetometer survey (resulted in the discovery of Reigle).

1974 NSDME AR 11E/09A 13-B-23 (02) Imperial Oil Limited.
Diamond drilling OH-2 and 3 both of which went immediately into Keppoch Formation basement.

1974 NSDME AR 11E/09A 13-B-23 (03) Imperial Oil Limited.
Geochemical, soils, silts (Cu, Pb, Zn), geological mapping, geophysical surveys.

1975 NSDME AR 11E/09A 13-B-23 (04) Imperial Oil Limited.
Soil survey (Cu, Pb, Zn, Mn).

1977-8 NSDME AR 11E/09A 07-B-23 (01) Don Black
Base metal potential of the Antigonish basin. Presents gravity data. Nova Scotia Research Foundation, 1955.

1978 NSDME AR 11E/09A 07-B-23 (02) Imperial Oil Limited.
Geochemical surveys 124 profile soil samples (Cu, Pb, Zn, Ba).

1978 NSDME AR 11E/09A 07-B-23 (04) Imperial Oil Limited.
Soils (Cu, Pb, Zn).

RESULTS OF THE 1987 FIELD CHECK: (Northcote and DeMont)

A number of mineralized and unmineralized samples were taken from the Keppoch Formation and lower Windsor limestone at the Reigle occurrence for petrographic and for major and trace element analyses. Samples were analyzed at Bondar Clegg Laboratory, Ottawa, using a combination of Direct Irradiation, D.C. Plasma, X-ray Fluorescence and Atomic Absorption methods. Table 1 gives a brief petrographic description of the samples and Table 2 lists the results of the analyses.

Because the mineralized samples were not in place, the analytical results are not representative of grade. The analyses indicate nothing of economic significance other than Cu, Pb and Zn which were already known.

GENESIS:

The disseminated sulphide mineralization in the Keppoch Formation is probably of volcanogenic origin. Copper, lead and zinc mineralization in veinlets is likely epigenetic hydrothermal.

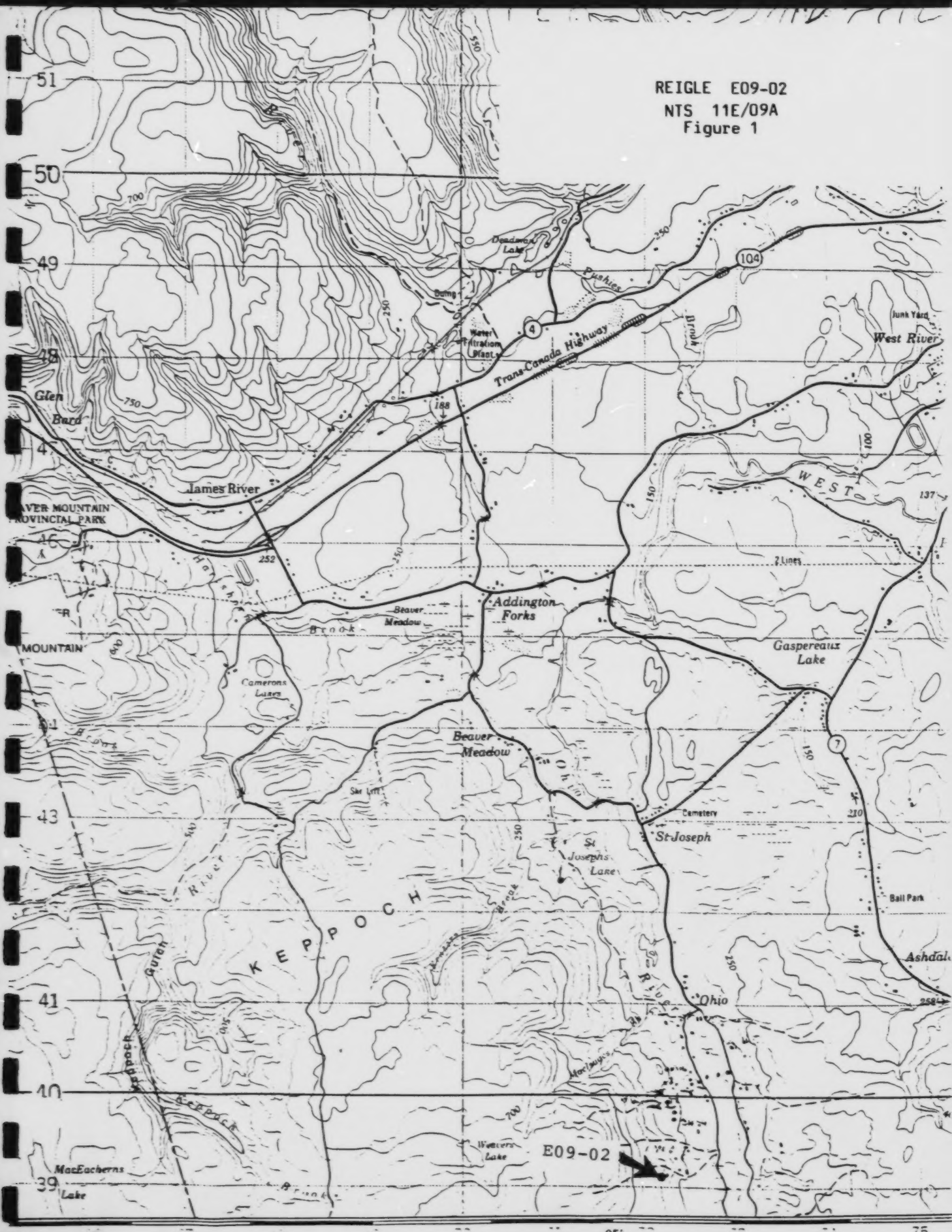
TABLE 1
REIGLE OCCURRENCE
SAMPLE DESCRIPTIONS

Sample #	Lithology	Mineralization	Form	Type
87 RGLE 3601	Keppoch felsic volcanogenic breccia (float)	Pyrite	Disseminated	Chip Pits SW of caved ls working
87 RGLE 3602	Keppoch felsic volcanogenic breccia (float)	Pyrite	Disseminated	Chip Pits SW of caved ls working
87 RGLE 3603	Lower Windsor limestone	Chalcopyrite Galena	Disseminated in calcite veinlets	Chip At caved ls working
87 RGLE 3604	Keppoch felsic volcanogenic breccia (float)	Pyrite	Disseminated	Chip Pits SW of caved ls working
87 RGLE 3605	Keppoch felsic volcanogenic breccia (float)	Pyrite	Disseminated	Chip Pits SW of caved ls working
87 RGLE 3606	Keppoch felsic volcanogenic breccia (float)	Pyrite	Disseminated	Chip Pits SW of caved ls working
87 RGLE 3607	Keppoch felsic volcanogenic breccia.	Unmineralized		Chip Outcrop area northeast of ls

TABLE 2
REIGLE OCCURRENCE ANALYSES

| REIGLE AU + 35 | | |

REIGLE E09-02
NTS 11E/09A
Figure 1



REIGLE
GRID AND DRILLHOLE LOCATIONS
IMPERIAL OIL LIMITED
Figure 2

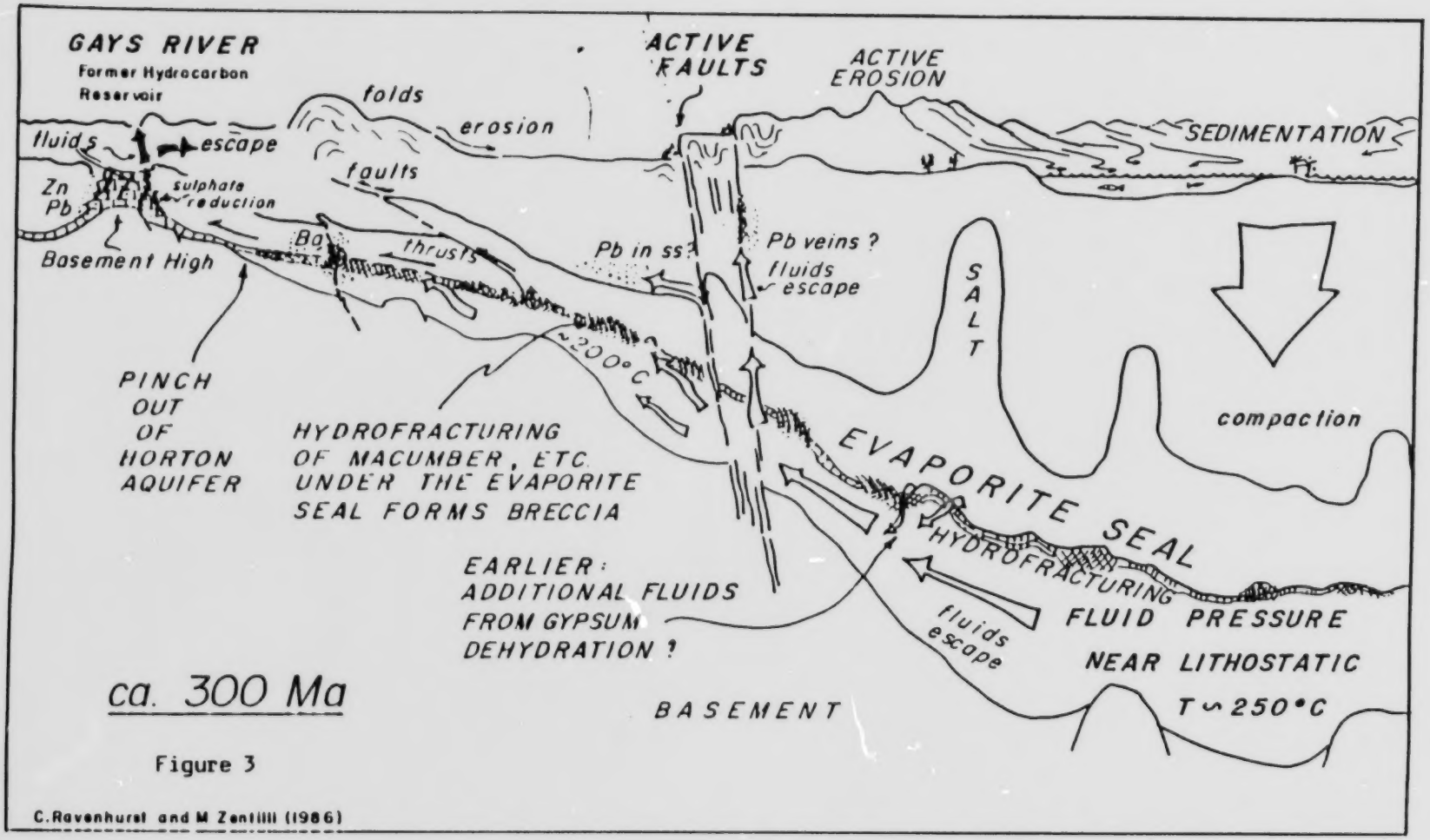


Fig. 8. The conceptual model. Overpressured fluids escape from deep in the southern part of the Magdalen Basin by a hydrofracturing mechanism. These hot, rapidly moving brines cause extensive brecciation and dissolution near the top of the aquifer — the Pembroke Breccia — under the evaporite seal. Deposits of Pb-Zn-Ba are formed at reducing sites at the margins of the basin by the hot mineralizing brines.

MACLEAN

OCCURRENCE: MACLEAN OCCURRENCE E09-09 (Copper)

LOCATION: 5439910N 572080E NTS 11E/09A

ACCESS:

From the west end of Ohio bridge, drive south along the main road on the west side of Ohio River for 0.9 km to the former Ron MacLean farm (presently occupied by the Layes family). Drive up the access road to the farmhouse and approximately 200 m beyond. On bearing 253° walk 150 m to the area of the workings.

The workings include a water-filled shaft, said to be about 12 m deep, in Keppoch volcanics on the southwest and a 3-4 m deep trench blasted in bedrock following the basal Windsor breccia - Lower Windsor limestone fault contact.

REFERENCES:

Binney, W. P., 1975. Copper occurrences in Lower Carboniferous sedimentary rocks of the Maritime provinces. GSC Open File 281, 1975, 156 pp.

Binney, W. P. and Kirkham, R. V., 1974. A study of copper mineralization in Mississippian rocks of Nova Scotia. GSC Paper 41-1, Part A, p. 129-130.

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Northcote, K. E., Keppie, J. D., DeMont, G. and Murphy, J. B., 1987. Investigation of the mineral potential of the Keppoch Formation, Antigonish Highlands. *In* Mines and Minerals Branch, Report of Activities 1987, Part A, eds. J. L. Bates and D. R. MacDonald, NSDME Report 87-5, p. 143-144.

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AR 11E/08D 07 B 33 (01),
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MINERAL POTENTIAL:

The basal Windsor breccia/conglomerate hosts a number of past-producing lead-zinc-silver-barite mines including Yava, Walton, Pembroke, Gays River, Brookfield and Smithfield. Many additional copper and lead-zinc-silver-barite mineral occurrences are known in the same horizon. The basal Windsor unconformity is, therefore, of important economic significance.

The Cross Roads-Ohio-James River-Antigonish trend of basal Windsor breccia/conglomerate hosts a number of copper occurrences with lesser lead and zinc. Some disseminated copper, lead and zinc mineralization is also found in the lower Windsor limestone. Although copper occurrences at the basal Windsor unconformity are numerous, none have yet supported significant production.

PREVIOUS WORK:

1951 NSDME AR 11E/09A 13 B 23 (00).
Bernard Keating sampled the basal Windsor breccia at the MacLean occurrence prior to and following blasting and obtained the following values:
(a) 1.8 m (6ft) 0.8% Cu and small amount of Ag prior to blasting.
(b) 2.9 m (9.4ft) 0.93% Cu and low Ag, Au content following blasting.

1952 Gravity and magnetometer surveys done along road systems by Nova Scotia Research Foundation.

1966 Kennco Explorations (Canada) Limited.

DDH H2	0 to 185	overburden
	185 to 200	leached limestone
	200 to 213	micritic skeletal limestone
	213 to 218	basal Windsor breccia
	218 to 241	Keppoch

1974 NSDME AR 11E/09A 13 B 23 (01),(03) Imperial Oil.
Geological mapping, geochemical soil, silt (Cu, Pb, Zn). Geophysical ground magnetometer survey.

NSDME AR 11E/09A 13 B 23 (02) Imperial Oil.
Diamond drilling.
OH-1 Limestone reefal development and 6.1m (20ft) of basal breccia. Minor mineralization in two horizons.
OH-4 Good section of A-1 carbonate and basal breccia/conglomerate, minor mineralization.

1975 NSDME AR 11E/08D 07 B 33 (01) Imperial Oil.
Airborne magnetometer survey (Kenting Earth Sciences). Ground magnetometer and gravity surveys.

NSDME AR 11E/09A 13 B 23 (04) Imperial Oil.
Geochemical soil (Cu, Pb, Zn, Mn).

1978 NSDME AR 11E/09A 07 B 23 (03) Esso Minerals Canada.
Diamond drilling, 5 holes totalling 533 ft. to test soil anomalies north of MacLean, (1977).
OH-7 Through overburden into Keppoch.
OH-8 Basal conglomerate 1.9 m 0.09 % Cu.
OH-9 Abandoned in overburden.
OH-10 Abandoned in overburden.
OH-10A Limestone at 39 to 58 m and penetrated 3.7 m of basal breccia 60 to 61.3 m, 0.25% Cu.

1980 NSDME AR 11E/09A 07 B 23 (06) Esso Minerals Canada.
Diamond drilling, 10 holes basinward from MacLean. Two of the holes had encouraging results:
OH-15 0.6 m 11.70% Pb, 0.56% Zn in basal conglomerate.
OH-16 2.6 m 2.98% Pb, 0.61% Zn in basal conglomerate.

GEOLOGY OF THE MACLEAN OCCURRENCE:

At the MacLean occurrence Keppoch Formation volcanogenic breccia appears to be unconformably overlain by about 3 m of mineralized, very gently northeasterly-dipping, poorly stratified Windsor Group basal breccia. A northwesterly-trending, near vertical fault, 124°/70° NE, approximately 1 m in width, forms the contact between the basal breccia and overlying Windsor Group limestones on the east.

The workings include a water-filled shaft, said to be about 12 m deep in Keppoch volcanics on the southwest and a deep trench which follows the fault contact northwesterly for several metres.

RESULTS OF 1987 FIELD CHECK: (Northcote and DeMont)

Petrography:

Keppoch Formation:

The Keppoch volcanogenic, felsic, lithic, tuffaceous breccia is polymictic, with abundant rhyolite clasts containing conspicuous quartz, and interstitial K-feldspar in a felted plagioclase groundmass. The felsic clasts have a bleached appearance resulting from sericite, carbonate and chlorite alteration.

Basal Windsor Breccia:

The basal Windsor breccia is composed of fragments (up to several cm long) of the Keppoch volcanogenic breccia in a finer matrix composed of lithic and crystal grains in a calcareous matrix. The fabric of the breccia shows lithic fragments that have been fractured in place and zones of cataclasis primarily in the calcareous matrix.

Windsor Limestone:
The overlying limestones are light grey in colour, thinly bedded and in thin section appear to be partially recrystalized detrital carbonate.

Mineralization:

Keppoch Formation:
The Keppoch volcanogenic breccia in the vicinity of the shaft shows no appreciable mineralization.

Basal Windsor Breccia:

Clasts:
The volcanogenic breccia clasts (lithic fragments and tuffaceous matrix) are weakly mineralized by disseminations and beaded fracture fillings of pyrite, chalcopyrite, hematite and minor sphalerite.

Groundmass:
Sulphide mineralization is strongest in the basal (secondary) breccia matrix and in that regard resembles the stockwork breccias at Cross Roads - Ohio. Mineralization consists of disseminations, pods, fracture fillings and veinlets of pyrite, marcasite, and chalcopyrite with lesser sphalerite, minor covellite and arsenopyrite, and a trace of galena. Hematite and malachite are also conspicuous.

Windsor Limestone:
The overlying limestone is weakly mineralized by disseminated chalcopyrite.

Table 1 summarizes petrology and mineralization of the MacLean occurrence.

ANALYSES: (Northcote and DeMont)

Samples were analyzed at Bondar Clegg, Ottawa, using a combination of Direct Irradiation/INAA, Atomic Absorption, X-ray Fluorescence, and D. C. Plasma for 36 elements and 10 oxides. The 5 samples analyzed represent underlying Keppoch volcanogenic breccia, basal Windsor breccia (secondary), and Lower Windsor limestone. A whole rock analysis was made of the Keppoch volcanogenic breccia.

Basal Windsor breccia gave the only significant results, which are as follows: Cu 1.04 and 0.35%, Zn 1.10 and 0.03%; Pb 0.06 and 0.01%, and As 421.0 and 40.0 ppm.

Mineralized samples were selected for petrographic and chemical analyses, so are not indicative of grade. Table 1 summarizes lithology, alteration and mineralization of each sample that was analyzed. Table 2 is a list of analyses and assays for the MacLean occurrence.

The form of mineralization and mineral assemblage at the MacLean occurrence resembles that of Cross Roads-Ohio. However mineralization at MacLean is in a Windsor Group basal breccia whereas that at Cross Roads-Ohio is in a secondary breccia developed in a Keppoch Formation primary, volcanogenic breccia.

GENESIS:

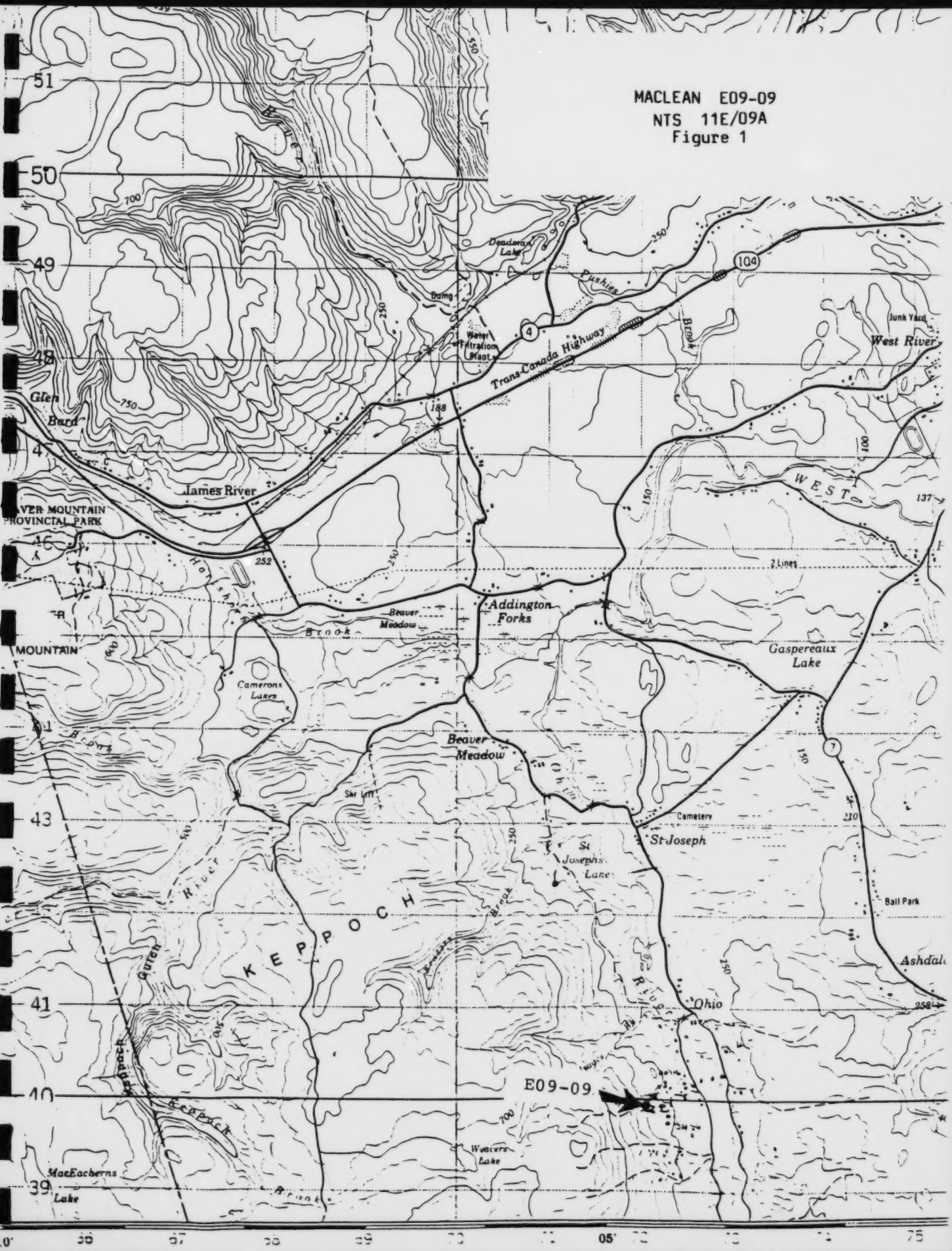
Mineralization at the MacLean occurrence has been ascribed by Bourque, 1981, to the model proposed by other researchers for copper mineralization at the Horton - Windsor unconformity throughout Nova Scotia, and for similar geologic environments elsewhere (Collins, 1974; Binney, 1975; Binney and Kirkham, 1974, 1975; Kirkham, 1978; Bourque, 1981; Smith and Collins, 1984). In essence, the model derives complexed copper in solution from within an oxidizing environment in Horton Group sediments, in this case in the Antigonish Basin.

During compaction of the sediments, oxidizing solutions moved outward and upward until they reached the Horton-Windsor unconformity (or basal Windsor breccia). Here they encountered a reducing environment resulting from decaying organic material and obtained sulphur from overlying Windsor sulphate evaporites. As a result there was zoned deposition of iron sulphides (pyrite) and copper sulphides (chalcopyrite, bornite, chalcopyrite, chalcocite, covellite, neodiginite, etc.), with lesser amounts of sphalerite and galena. A similar but more sophisticated model supported by field observations and research is proposed for economic lead, zinc and barite deposits occurring at the contact between the Horton and Windsor Groups at Pembroke (Ponsford, 1983) and at Gays River (Ravenhurst and Zentilli, 1987) and is applied to Walton, Brookfield and Smithfield. Some fluid inclusion studies were done indicating mineralization temperatures in the order of 100°C for pyrite in the basal breccia at the Windsor unconformity at the western edge of the Antigonish Basin (Bourque, 1981). Additional fluid inclusion and stable isotope studies of separate mineral phases and generations are required in order to help resolve age and origin of this potentially economically significant copper mineralization.

AGE OF MINERALIZATION

The age of mineralization is ca. 300 Ma for Gays River and Pembroke and is expected to be of similar age along the Cross Roads -Ohio trend (Ravenhurst and Zentilli, 1986; Ponsford, 1983).

MACLEAN E09-09
NTS 11E/09A
Figure 1



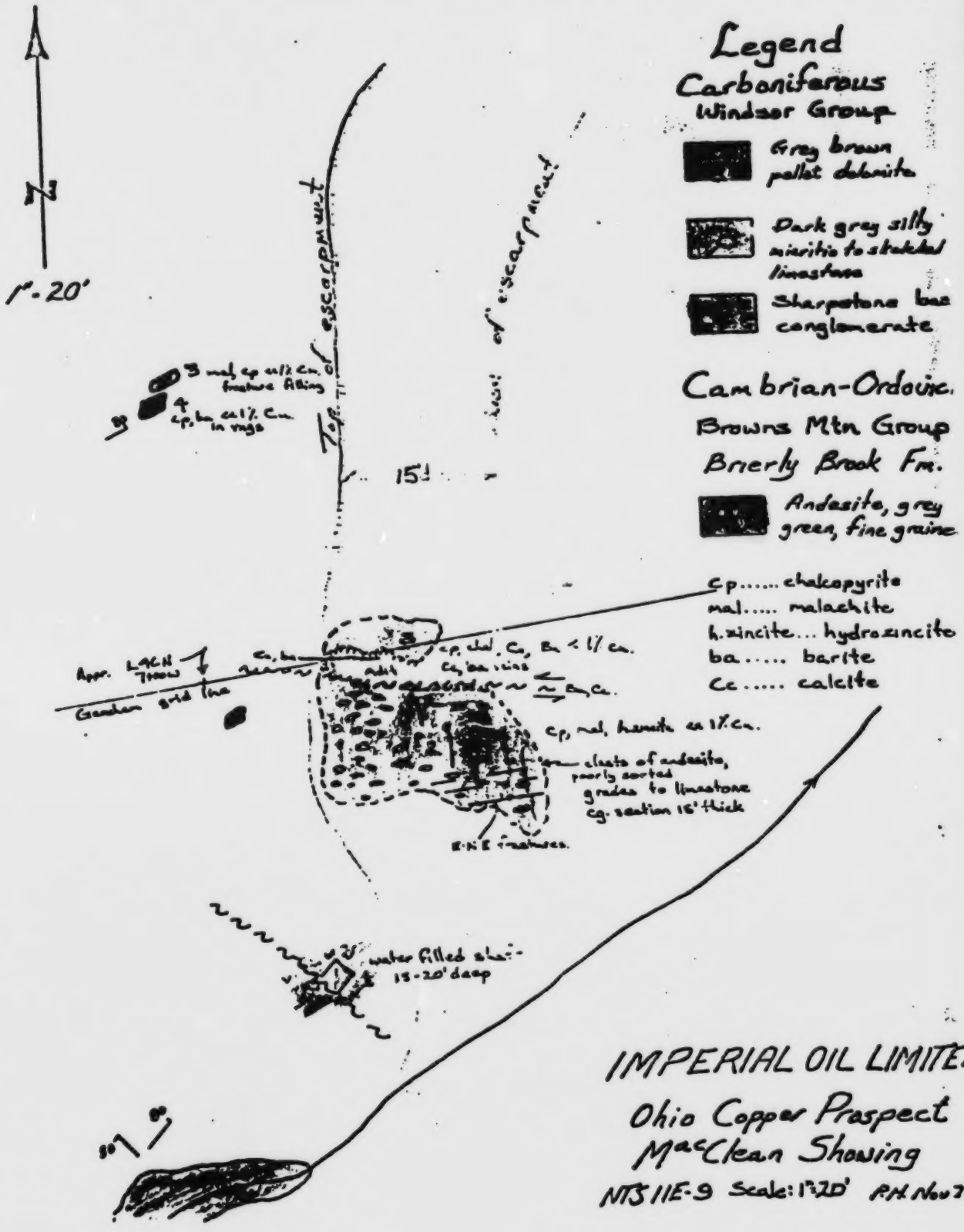

Legend
Carboniferous
Windsor Group
Grey brown pellet dolosite
Dark grey silty micritic to stromatol limestone
Sharpstone bx conglomerate
Cambrian-Ordovic.
Browns Mtn Group
Brierly Brook Fm.
Andesite, grey green, fine grained
cp..... chalcopyrite
mal..... malachite
h.zincite... hydrozincite
ba..... barite
Cc..... calcite
Top of escarpment
Base of escarpment
15'
Appr. LAKE TRAIL
Gridline
cp, mal, hemite ca 1% Cu.
cleats of andesite, poorly sorted grades to limestone cg. section 16' thick
E-NE trenches
water filled shaft 15-20' deep
IMPERIAL OIL LIMITED
Ohio Copper Prospect
MacClean Showing
NTS 11E-9 Scale: 1"=20' R.H. Nov 77

Figure 2

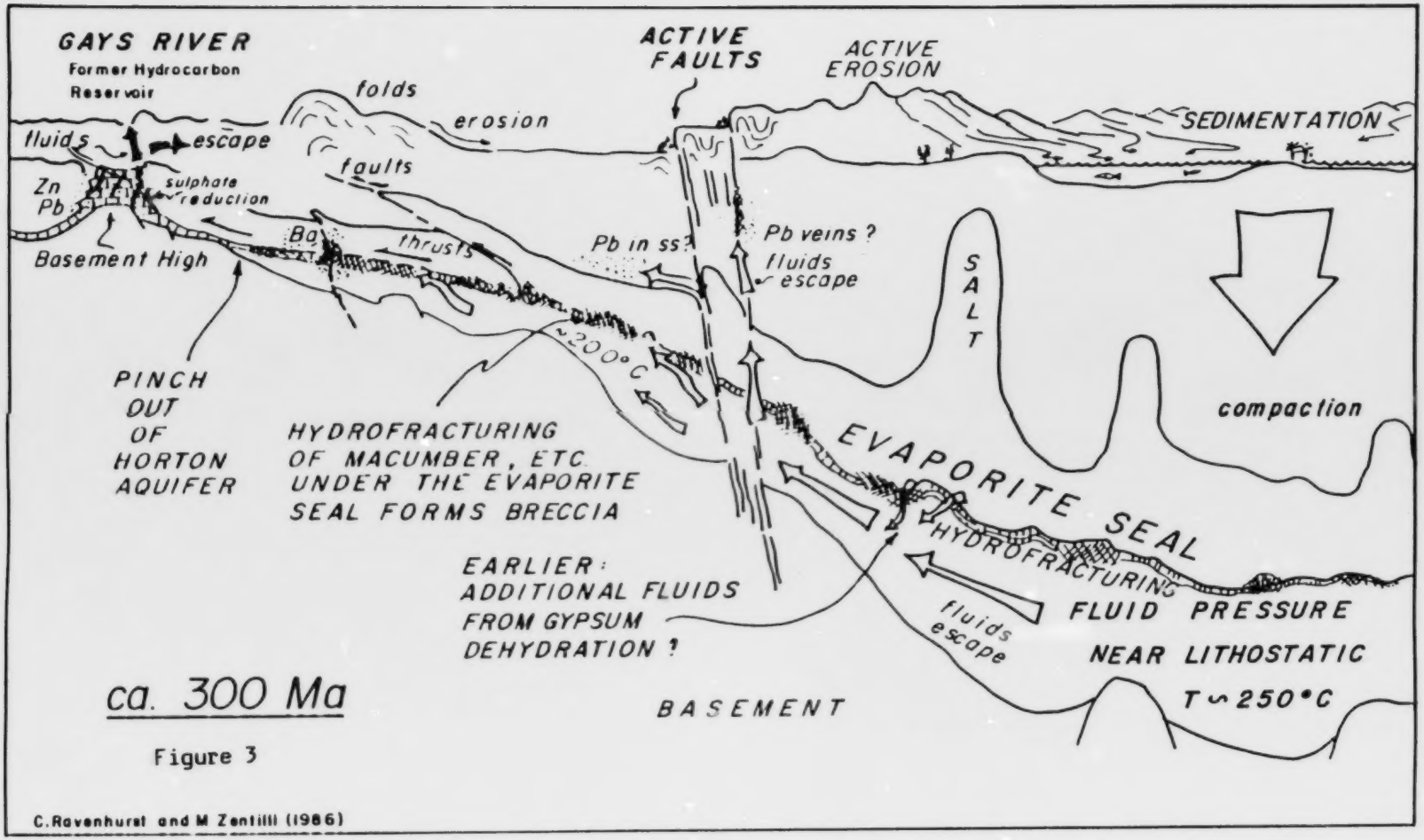


Fig. 8. The conceptual model Overpressured fluids escape from deep in the southern part of the Magdalen Basin by a hydrofracturing mechanism These hot, rapidly moving brines cause extensive brecciation and dissolution near the top of the aquifer — the Pembroke Breccia — under the evaporite seal Deposits of Pb-Zn-Ba are formed at reducing sites at the margins of the basin by the hot mineralizing brines

T15

TABLE 1
PETROGRAPHIC SUMMARY

	LITHOLOGY	ALTERATION	MINERALIZATION	
			FORM	
MACLEAN Keppoch Formation	Outcrop and Fragments (1) Felsic volcanogenic breccia, polymictic Both K-spar rich and K-spar poor lithic fragments	Sericite, carbonate	Fine disseminated	Py ch ha ma
Windsor Group	Calcareous Breccia Matrix (2) Secondary breccia Fragments of above in a calcareous matrix	carbonate	Clots at fragment boundaries.	Ch ha co sp
			Fracture filling.	Py ha sp ga ar
	(3) Limestone		Disseminated	Ch

TABLE 1
OGRAPHIC SUMMARY

ALTERATION	MINERALIZATION		
	FORM	MINERALOGY	SAMPLE NO.
cite, carbonate	Fine disseminated	Pyrite chalcopyrite (minor) hematite manganese oxide	8702
onate	Clots at fragment boundaries.	Chalcopyrite hematite covellite sphalerite (minor)	8701, 8703
	Fracture filling.	Pyrite/marcasite hematite sphalerite (minor) galena (tr) arsenopyrite?	
	Disseminated	Chalcopyrite	8704, 8705

T16

TABLE 1
MacLEAN MAJOR AND MINOR ELEMEN

MacLEAN 87 HCl	Au + 35 Na(%)	Au	Fe(%)												
0701A	1.02	7.1	1.14												
0701B	1.38		1.46												
0702	0.03	5.1	0.74												
0703	0.11	4.7	0.74												
0705	0.05	1.2	0.54												

MacLEAN 87 HCl	WHOLE ROCK ANALYSES SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	Total %
0702	65.9	0.25	17.1	2.58	0.07	0.78	1.1	5.36	5.6	<0.01	1.1	97.65

MacLEAN 87 HCl	Tix	FeX	Sr	Zr	Nb	Ba	Y	Li	F	Be	Mo	Pb	Rb	Ba
0702	0.36	1.3	106	285	14	<10	34	22	240	2		265	<1	621

MacLEAN 87 HCl	Cu (%)	Pb (%)	Zn (%)	Cl (%)	Ag ppm	Au ppb
0701A	0.55	0.04	1.1		2.6	25
0702				<0.01		
0705	1.04	0.01	0.03		4.6	<5

TABLE 1
AND MINOR ELEMENT ANALYSES

| | | |

GREENVALE OCCURRENCE

OCCURRENCE: GREENVALE E 09-10 (Gold ?)

LOCATION:

(a)	5038580 N	540340 E	NTS 11E/09B
(b)	5038420 N	540580 E	11E/09B-08C

ACCESS:

From McPhersons Mills, drive 2.0 km southeast on Highway #347 to the branch road leading to Sutherlands River. Take the Sutherlands River branch road to the junction then turn left, southeast, and follow the road toward Greenvale for 2.75 km to the southeast curve in "S" curve. At this point follow an access road leading off the curve southeast, past a graveyard, following the east side of Sutherlands River for a total of 0.7 km. A trench, in outcrop immediately to the east of the road, is 4 m long, 1.2 m wide and 1.6 m deep and trends 097°.

A second working is reported to be approximately 300 m farther southeast just to the east of the access trail. This location was not visited during the 1988 field check.

REFERENCES:

Bourque, D., 1979. Metallogenesis and mineral deposits of the Antigonish Highlands. NSDME OFR 383.

Bourque, D., 1981. A metallogenic study of the Antigonish area, Nova Scotia. M.Sc. Thesis, Dalhousie University, NSDME Thesis 459, 420 pp.

Fletcher, 1902. GSC Map 43 (#598) Stellarton Sheet, scale 1" to 1 mile.

Murphy, J. B., 1986. Geology of the Antigonish Highlands. GSC OPEN FILE 1181, Sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands, GSC Memoir.

NSDME AR 11E/08C 13-M-02 (01, 02)

NSDME AR 86-049. Noranda Exploration Company Limited, 1986.

NSDME Mines Report 1868. p. 8.

1895. p. 48.

GEOLOGIC ENVIRONMENT:

Mapping by Murphy (1986) indicates that occurrence 10(a) is in Hadrynian Keppoch Formation, Moose River Member, (H_{KM}) just north of the northeasterly-trending Browns Mountain fault. It is approximately in line with the northwest end of a major northwesterly-trending fault, passing west of Sutherlands Mountain and through Blue Mountain, truncated by the Browns Mountain fault. Occurrence 10(b) is near the junction of the two faults with the Moose River Member on the east and the Silurian Ross Brook Formation on the west of the Sutherlands - Blue Mountain fault.

PREVIOUS WORK:

Date of original discovery and trenching is not known.

1955 First organized mineral exploration by Eastern Northern Exploration Limited. The work included prospecting, geologic mapping and an airborne electromagnetic survey.

1965 (?) Detailed magnetic and soil sampling survey was done in an area surrounding a 2½ ton boulder which carried 2-3% copper as chalcopyrite associated with pyrite and pyrrhotite in silicified chlorite schist (Tract 9, Ref. Map 11E/09B).

1966-67 Report on Reconnaissance Geochemical Survey, Eon Trading Limited, Blue Mountain area, Pictou County, N.S., A.C.A. Howe International Limited. Regional geochemistry survey, 1,330 stream sediment samples tested for cold extractable total heavy metals.

1985 NSDME AR 86-049, Noranda Exploration Company Limited. Reconnaissance for stratiform volcanogenic gold by prospecting (rock chip sampling Au, Ag, (Cu)), silt (Cu, Pb, Zn, Ag, Au) and till and silt heavy mineral content (Au). The results of these surveys are given in Figure 2.

It is noted that recent work has paid no specific attention to vein systems which were the focus of interest of early exploration and development. In particular, the 1985 survey by Noranda was in search of bedded volcanic-related gold mineralization.

RESULTS OF THE 1988 FIELD CHECK (Northcote and Armitage)

A circular traverse was made in the vicinity of the two Greendale "occurrences" on the east side of Sutherlands River. No outcrop was found except at the 10(a) working. [The presence of the 10(b) occurrence was not noted on the MOD card until subsequently updated by G. DeMont.] The area has reverted to forested land from former cleared farmland. Rock has been picked from former field areas and piled along fencelines. Rock cleared from the old fields indicates that underlying bedrock is composed predominantly of foliated shale/phyllite, blue-grey argillaceous siltstone and argillaceous greywacke. These rocks are abundantly cut by white bull quartz gash veins, generally with no visible mineralization but commonly weakly iron-stained.

Occurrence 10(a) was examined and sampled for major and trace element analyses. A trench 4 m long, 1.6 m deep and 1.2 m wide follows 3 pinching and swelling quartz veins which more or less follow the foliation.
Foliation: 097°/40° - 48° N.
Main vein: 097°/63° N.
Lensoidal vein oriented 90° to foliation.

Four samples of country rock and veins were collected for analyses (Table 1).

TABLE 1

SAMPLES FROM GREENVALE 10(a)

Sample #	Lithology	Type
88 GV 405	Foliated chlorite schist	Chip
88 GV 406	Quartz vein	Chip
88 GV 407	Vein in chlorite schist	Chip
88 GV 408	Quarz vein	Chip

The four samples were analyzed by Direct Irradiation/INAA for Au + 33 and for rare-earth elements, Atomic Absorption (Cu, Pb, Zn, Ag) and Fire Assay/Atomic Absorption for Au.

RESULTS OF ANALYSES:

This very limited survey showed no values of economic significance in veins or wallrock.

GREENVALE E08-10
NTS 11E/09B
Figure 1

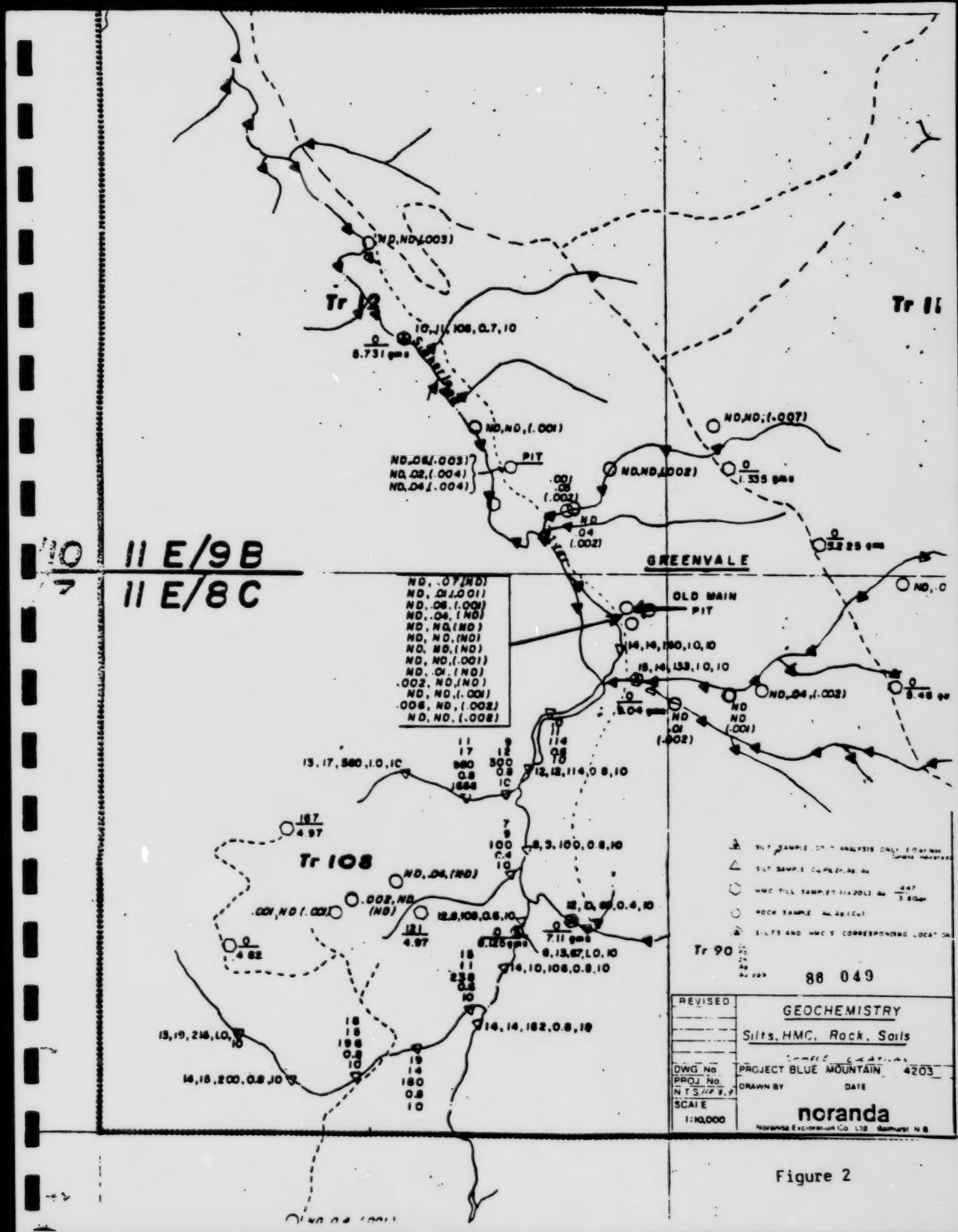

Tr 12
Tr 11
Tr 108
Tr 90
11 E/9B
11 E/8C
GREENVALE
OLD MAIN PIT
PIT
ND,ND,(.003)
ND,ND,(.001)
ND,ND,(.007)
ND,ND,(.002)
ND,.06,(.003)
ND,.02,(.004)
ND,.04,(.004)
ND,.07,(ND)
ND,.01,(.001)
ND,.06,(.001)
ND,.04,(ND)
ND,ND,(ND)
ND,ND,(ND)
ND,ND,(ND)
ND,ND,(.001)
ND,.01,(ND)
.002,ND,(ND)
ND,ND,(.001)
.006,ND,(.002)
ND,ND,(.002)
13,17,580,1.0,10
12,12,114,0.8,10
14,14,150,1.0,10
15,14,133,1.0,10
ND,.04,(.002)
ND,.01,(.002)
ND ND (.001)
8,3,100,0.8,10
12,12,88,0.4,10
ND,.04,(ND)
.001,ND(.001)
.002,ND,(ND)
12,8,108,0.8,10
8,13,67,1.0,10
14,10,106,0.8,10
14,14,182,0.8,10
13,19,218,1.0,10
14,18,200,0.8,10
88 049
REVISED
GEOCHEMISTRY
Silts, HMC, Rock, Soils
DWG No.
PROJ No.
PROJECT BLUE MOUNTAIN 4203
DRAWN BY
DATE
SCALE
1:10,000
noranda

Figure 2

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TABLE 2
GREENVALE ANALYSES

GREENVALE AU, AG, AS

SAMPLE	AU	AG	AS
88-GU	N.D.	1.4	4.4
1	N.D.	1.9	4.4

GREENVALE ATOMIC ABSORPTION, RARE EARTHS

SAMPLE	SC	LA	CE	PR	ND	SM	EU	GD	TB	DY	HO	ER	TM	YB	LU
88-GU	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
3	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
5	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
6	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
7	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
8	16	15	90	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

GREENVALE ATOMIC ABSORPTION

SAMPLE	CU	PB	ZN
88-GU	116	400.2	N.D.
1	116	400.2	N.D.
2	116	400.2	N.D.
3	116	400.2	N.D.
4	116	400.2	N.D.
5	116	400.2	N.D.
6	116	400.2	N.D.
7	116	400.2	N.D.
8	116	400.2	N.D.

MacISAACS BROOK OCCURRENCE

OCCURRENCE: MacISAACS BROOK: E 09-14 (Copper)

LOCATION: 5040710 N571740 ENTS 11E/09A

ACCESS:

Drive approximately 0.5 km north from the west end of Ohio bridge along the access road following the west side of Ohio River, then proceed west along an access road through a field to a branch in MacIsaacs Brook. Follow the north branch upstream for 100 m. Exposures of basal Windsor breccia occur on the south bank of the stream with a number of exposures of Keppoch volcanogenic breccia on both sides a few metres upstream (Fig. 1).

REFERENCES:

Binney, W. P., 1975. Copper occurrences in Lower Carboniferous sedimentary rocks of the Maritime provinces. GSC Open File 281, 1975, 156 pp.

Binney, W. P. and Kirkham, R. V., 1974. A study of copper mineralization in Mississippian rocks of Nova Scotia. GSC Paper 41-1, Part A, p. 129-130.

Binney, W. P. and Kirkham, R. V., 1975. A study of copper mineralization in Mississippian rocks of the Atlantic provinces. GSC Paper 75-1, Part A, p. 245-247.

Bourque, P. D., 1981. A metallogenic study of the Antigonish area, Nova Scotia, with special reference to the copper occurrences of the Ohio-Sylvan Glen belt. Unpublished M.Sc. Thesis, Dalhousie University, 420 pp.

Keppie, J. D., 1982. Tectonic map of the province of Nova Scotia. NSDME published map, scale 1:500 000.

Kirkham, R. V., 1978. Base metal and uranium distribution along the Windsor-Horton contact, central Cape Breton Island, Nova Scotia. GSC Paper 78-1B, p. 121-135.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highlands. GSC Open File 1181, Sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

Northcote, K. E., Keppie, J. D., DeMont, G. and Murphy, J. B., 1987. Investigation of the mineral potential of the Keppoch Formation, Antigonish Highlands. *In* Mines and Minerals Branch, Report of Activities 1987, Part A, eds. J. L. Bates and D. R. MacDonald; NSDME Report 87-5, p. 143-144.

NSDME ASSESSMENT REPORTS AR 11E/09A 13 B 23 (00), (01), (02), (03), (04),
AR 11E/08D 07 B 33 (01),
AR 11E/09A 07 B 23 (01), (03), (06)

Ponsford, M. A. P., 1983. Geologic, fluid inclusion, and stable isotope study of a carbonate-hosted lead deposit at Pembroke (Glenbervie), Colchester County, Nova Scotia. Unpublished B.Sc. Thesis, Dalhousie University, 65 pp.

Ravenhurst, C. and Zentilli, M., 1987. A model for the evolution of hot (>200°C) overpressured brines under an evaporite seal: the Fundy, Magdalen Carboniferous basin of Atlantic Canada and its associated Pb-Zn-Ba deposits. *In* Sedimentary Basins and Basin-Forming Mechanisms, eds. C. Beaumont and A. J. Tankard. Canadian Society of Petroleum Geologists, Memoir 12, p. 335-349.

Smith, L. and Collins, J. A., 1984. Unconformities, sedimentary copper mineralization and thrust faulting in the Horton and Windsor Groups, Cape Breton Island and Central Nova Scotia. 9th International Congress of Carboniferous Stratigraphy and Geology, 1979. Compte Rendu, v. 3, p. 105-116.

TECTONIC ENVIRONMENT:

In the southeast Antigonish Highlands calcareous Windsor Group rocks of Carboniferous age unconformably overlie Hadrynian Keppoch felsite volcanics and the Late Precambrian - Cambrian Ohio Pluton. Basinward the unconformity separates the Horton from overlying Windsor Group. A basal breccia/conglomerate 2-4 m thick, part of the Windsor Group, rests on the unconformity. The poorly stratified, fragment supported basal breccia is composed predominantly of angular to subangular felsic volcanic and plutonic fragments which appear to have been derived from the Keppoch Formation and Ohio pluton. The matrix of the basal breccia/conglomerate is composed of fine lithic and crystal fragments in a calcareous groundmass. The basal breccia/conglomerate is conformably overlain by bedded, detrital Windsor Group limestone.

MINERAL POTENTIAL:

The basal Windsor breccia/conglomerate hosts a number of past-producing lead-zinc-silver-barite mines including Yava, Walton, Pembroke, Gays River, Brookfield and Smithfield. Many additional copper and lead-zinc-silver-barite mineral occurrences are known in the same horizon. The basal Windsor unconformity is, therefore, of important economic significance.

The Cross Roads-Ohio-James River-Antigonish trend of basal Windsor breccia/conglomerate hosts a number of copper occurrences with lesser lead and zinc. Some disseminated copper, lead and zinc mineralization is also found in the lower Windsor limestone. Although copper occurrences at the basal Windsor unconformity are numerous, none have yet supported significant production.

PREVIOUS WORK:

1952 Nova Scotia Research Foundation Gravity and Magnetometer road surveys.

1974 NSDME AR 11E/09A 13-B-23 (01) Imperial Oil Limited.
Geological mapping.
Geochemical soil and silt surveys (Cu, Pb, Zn).
Ground magnetometer survey.

1975 NSDME AR 11E/08D 07-B-33 (01) Imperial Oil Limited.
Airborne magnetic survey (Winter 1973-4).
Ground magnetic and gravity survey.

1977-8 NSDME AR 11E/09A 07-B-23 (01).
Base metal potential of the Antigonish basin.
Don Black presents gravity data by Nova Scotia Research Foundation (1955).

RESULTS OF THE 1987 FIELD CHECK: (Northcote and DeMont)

Geology of the MacIsaacs Brook Occurrence:

Mineralization is hosted in an easterly dipping, weakly stratified, secondary breccia, approximately 2 m in thickness, immediately underlain by massive Keppoch Formation. It is not known whether the breccia is tectonic or, as generally assumed, a basal breccia at the base of the Windsor Group, unconformably overlying Keppoch Formation. The contact with underlying Keppoch rocks is not exposed and the expected overlying Windsor Group limestones to the east are also covered.

Keppoch Formation:

The Keppoch rocks are dark, massive, and dense in outcrop. Lithic fragments, which are visible on close inspection, form a primary breccia in an aphanitic, tuffaceous matrix and are a polymictic mix of felsic pyroclastic and flow rocks. These rocks show weak sericite, chlorite and carbonate alteration.

Basal Windsor Breccia:

The secondary breccia is composed of angular fragments of Keppoch Formation felsic, polymictic, lithic, tuffaceous breccia (primary breccia) in a fine granular, weakly layered, matrix. Hydrothermal alteration of the secondary matrix is weak. It is calcareous, weakly sericitic and contains localized cataclastic textures.

Mineralization:

Petrographic studies show that the strongest mineralization occurs within clasts of Keppoch-derived volcanogenic breccia within the "basal Windsor breccia" and, to a lesser extent, in the basal breccia matrix.

Clasts:

Volcanogenic breccia clasts show strong (1-3%) disseminated chalcopyrite and pyrite with lesser sphalerite unevenly distributed among lithic fragments and throughout the tuffaceous matrix. The mineralization is concentrated within specific lithic fragments with adjacent fragments relatively barren and occurs as clusters of grains randomly distributed in the tuffaceous matrix. Chalcopyrite partially replaces crystals of mafic minerals, feldspar, and ilmenite. It shows a tendency for concentration at edges of crystals and at the margins of lithic clasts. Partially replaced crystals in the matrix appear fragmental. Numerous minute chalcopyrite-filled fractures also occur in the primary breccia fragments.

Basal Breccia Matrix:

The matrix of the secondary breccia is only weakly mineralized but contains calcite veinlets mineralized by clusters of coarse chalcopyrite concentrated along margins of lithic fragments.

ANALYSES: (Northcote and DeMont)

Three samples were analyzed for 46 elements and 10 oxides at Bondar Clegg Laboratory, Ottawa, by a combination of Direct Irradiation/INAA, Atomic Absorption, X-ray Fluorescence, D.C. Plasma and conventional assay. The samples included two of secondary breccia and one of volcanogenic breccia. Both samples of secondary breccia are chip samples taken about 1 m across the exposure and should be representative of the secondary breccia.

Samples of secondary breccia gave subeconomic values for copper 0.06%, zinc <0.01%, lead <0.01%, silver 0.4 ppm, and gold 4 ppb. The felsic, volcanogenic breccia gave a value of 11 ppb for gold. Table 1 lists and gives a description of the samples. Table 2 lists the results of the analyses.

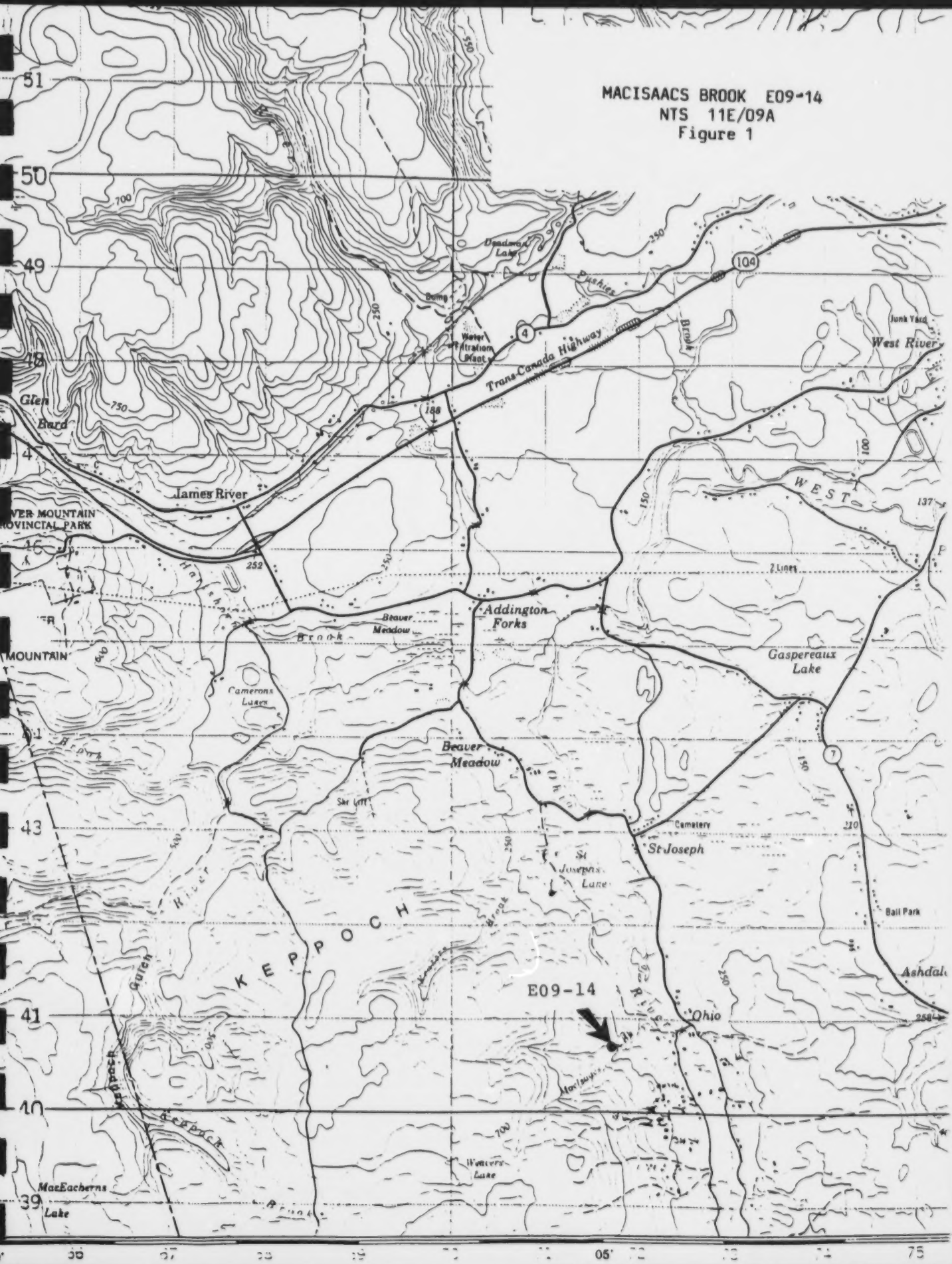
GENESIS:

Examination of thin and polished sections from the MacIssacs Brook occurrence suggests a complex geological history. Uneven distribution of sulphides in

adjacent lithic clasts and in crystal fragments in the matrix of primary breccia supports the suggestion that mineralized lithic clasts and crystal fragments in the matrix of the primary breccia were broken up from an earlier volcanic horizon and redeposited during continuing volcanism (Chatterjee, personal communication, 1988). Deposition of the volcanogenic breccia appears to have been followed by some remobilization and redeposition of sulphides in fractures.

Subsequently, the volcanogenic breccia was rebrecciated, to form a secondary breccia, either as a tectonic or basal breccia at the unconformity at the base of the Windsor Group. Chalcopyrite-bearing calcite veinlets in the matrix of the secondary breccia may be the result of further remobilization and deposition of sulphides after fracturing, or some later mineralizing event. The latter includes the proposal for the origin of metals from within sediments of the Antigonish Basin with deposition in basal Windsor breccia (Bourque, 1981).

MACISAACS BROOK E09-14
NTS 11E/09A
Figure 1



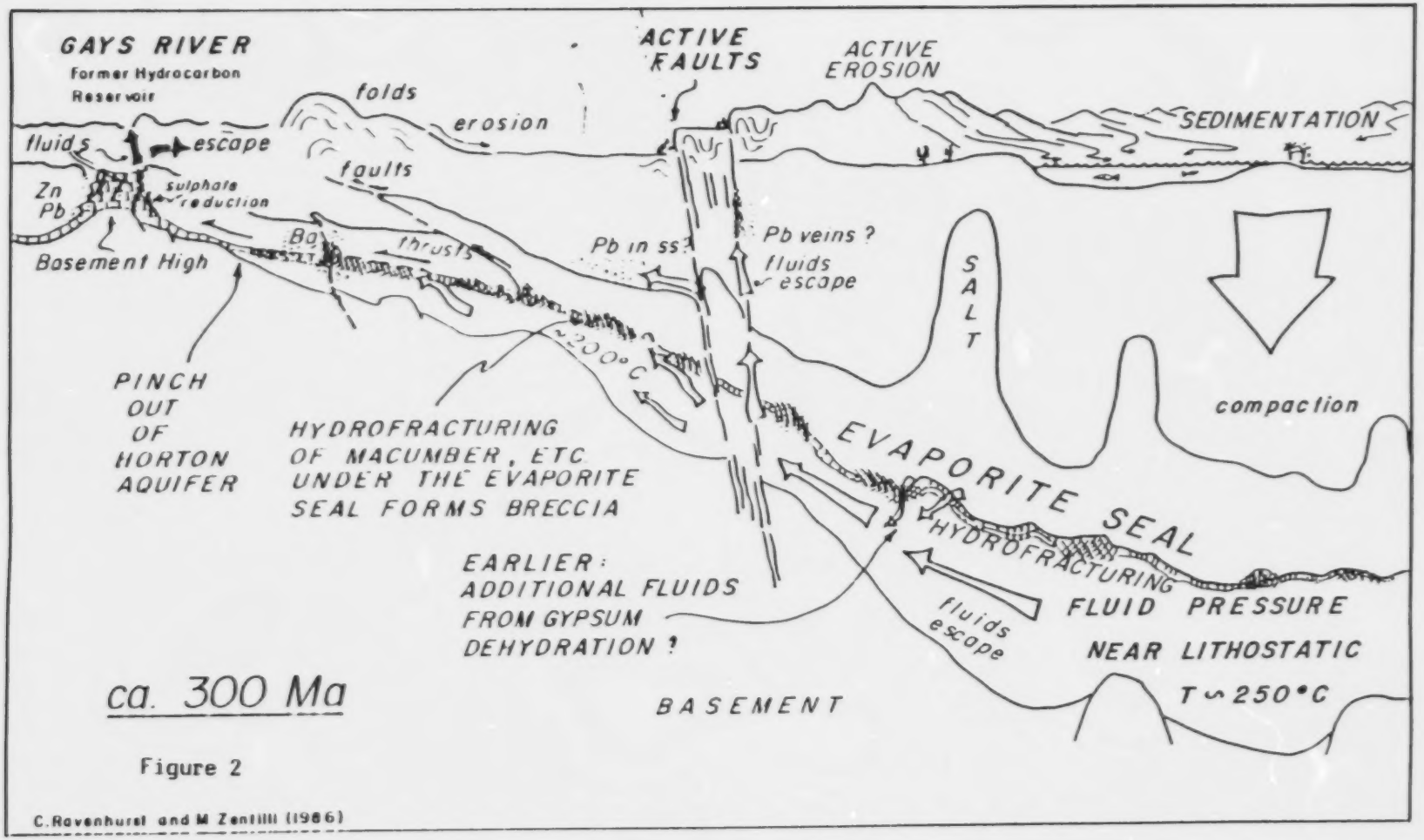


Fig. 8. The conceptual model. Overpressured fluids escape from deep in the southern part of the Magdalen Basin by a hydrofracturing mechanism. These hot, rapidly moving brines cause extensive brecciation and dissolution near the top of the aquifer — the Pembroke Breccia — under the evaporite seal. Deposits of Pb-Zn-Ba are formed at reducing sites at the margins of the basin by the hot mineralizing brines.

TABLE 1
PETROGRAPHIC SUMMARY

LITHOLOGY	ALTERATION	MINERALIZATION FORM	MINERALOGY	SAMPLE NO.
MACISAAC'S BROOK				
Kappoch Formation Outcrop and Fragments				
(1) Felsic volcanogenic	Sericite, carbonate	Fragmental	Chalcopyrite	8602
(a) breccia fragments	Bleached, hydrothermal alteration	Replacement Disseminated Fracture filling Replacement	sphalerite pyrite	
(b) breccia matrix	Sericite, carbonate	Disseminated, aggregates Fracture filling		
Windsor Group Calcareous Breccia Matrix				
(2) Secondary breccia matrix	Carbonate	Calcite veinlets bordering felsite fragments	Chalcopyrite	8601, 8603

TABLE 1
PETROGRAPHIC SUMMARY

	LITHOLOGY	ALTERATION	MINERALIZATION FORM	MINERALOGY	SAMPLE NO.
MACISAACS BROOK					
Keppoch Formation	Outcrop and Fragments				
	(1) Felsic volcanogenic				
	(a) breccia fragments	Sericite, carbonate Bleached, hydrothermal alteration	Fragmental Replacement Disseminated Fracture filling Replacement	Chalcopyrite sphalerite pyrite	8602
	(b) breccia matrix	Sericite, carbonate	Disseminated, aggregates Fracture filling		
Windsor Group	Calcareous Breccia Matrix				
	(2) Secondary breccia matrix	Carbonate	Calcite veinlets bordering felsite fragments	Chalcopyrite	8601, 8603

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TABLE 2
MacISSACS BROOK MAJOR AND MINOR ELEMENT ANALYSES

MacISSACS BROOK; Ag + 33

97 OH	Na(%)	Sc	Cr	Fe(%)	Co	Ni	Cu	Zn	As	Rb	Sr	Mo	Ag	Cd	Sn	Sb	Te	Cs	Ba	W	Au	Hg	Tl	Pb	Bi	Th	U
0601	NN.13	7.19	141	5.56	NNNO	AAAH	A 110N	AN0.28	AAAR	AAAR	0B0B	N0B0N	A--N	AAA3	AAAS	AAA1	000.5	AAA1	0N.0	0.00	AAA2	AAA1	0000	0.00	0.00	0.00	0.00
0602	NN.08	23.17	146	N0.06	0000	0000	A 110N	AN0.NN	0000	0000	0000	0000	1--N	NNN0	0000	0000	0.04	0000	0.0	0.00	0000	0000	0000	0.00	0.00	0.00	0.00
0603	1.7	10	41	N.9	0000	0000	A 110N	AN0.NN	0000	0000	0000	0000	1--N	NNN0	0000	0000	0.04	0000	0.0	0.00	0000	0000	0000	0.00	0.00	0.00	0.00

MacISSACS BROOK; WHOLE ROCK ANALYSES

97 OH	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	Total %
0602	54.9	1.04	17.1	9.01	0.19	4.28	2.79	3.76	2.79	0.25	1.9	97.99

MacISSACS BROOK;

97 OH	Ti (%)	Fe (%)	Sr	Zr	Nb	Ga	Y	Li	F	Be	Hg(ppb)	Bi	Ba
0602	0.88	4.7	332	159	7	<10	38	22	650	N	10	<1	652

MacISSACS BROOK ASSAYS;

97 OH	Cu (%)	Pb (%)	Zn (%)	Cl (%)	Ag ppm	Au ppb
0601	0.06	<0.01	<0.01		0.4	<5
0602				<0.01		

ARISAIG BROOK IRON

OCCURRENCE: **ARISAIG BROOK IRON E09-17 (Iron)**
(TRUNK ROAD MINE)

LOCATION:

From Highway 245 at Arisaig, drive up Arisaig Brook road (MacDonalds road) 0.6 km. The road is on the west side of the brook at this point. A small adit in bedded hematite is clearly visible about 5 m above water level on the east side of the brook. A second smaller excavation is visible in the same hematite bed on the west side of the road.

REFERENCES:

Bourque, P. D., 1981. A Metallogenic Study of the Antigonish Area, Nova Scotia, with Special Reference to the Copper Occurrences of the Ohio-Sylvan Glen Belt. Unpublished M.Sc. Thesis, Dalhousie University, 420 pp.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., 1982. Geology Map of the Northern Antigonish Highlands, Nova Scotia. NSDME Map 82-5, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands, GSC Memoir.

GEOLOGIC ENVIRONMENT:

The bedded oolitic hematite is in the Silurian McAdam Formation, a succession of siltstone, shale and minor limestone. A 0.6 m bed of massive oolitic hematite rests conformably between nearly vertical (038°/80°SE) beds of medium grey micaceous slaty siltstone.

PREVIOUS WORK:

Adits: East side of road, 9.8 m long, 0.8 m wide, 5.0 m high. West side of road, 36.5 m from first adit, 2 m deep, 0.8 m wide.

Reported 55-75% hematite with 25-45% fine grained siliceous clasts.

Previous Assays:
Analyses of a shipment of ore by Dominion Iron and Steel Company (1902) gave:

	Values in per cent			
	(1)	(2)	(1)	(2)
Iron	52.9	52.34	35.26	35.62
Silica	11.6	16.10	17.6	--
Alumina	7.4	8.76	7.0	--
Lime	--	--	11.7	--
Magnesia	--	--	.42	--
Phosphorus	.49	.37	.85	--
Sulphur	--	Tr	.019	--

RESULTS OF 1988 FIELD CHECK (Northcote and Armitage)

This occurrence was previously well documented in the MOD. The occurrence was sampled (Table 1) for trace element analyses of Au +33 additional elements by Direct Irradiation/INAA, and Atomic Absorption for Cu, Pb, Zn, Ag and Fire Assay/Atomic Absorption for Au. The results of the analyses (Table 2) showed 26% and 56% Fe for the two hematite samples and no other elements of economic significance.

Additional analyses for a wider range of elements is recommended.

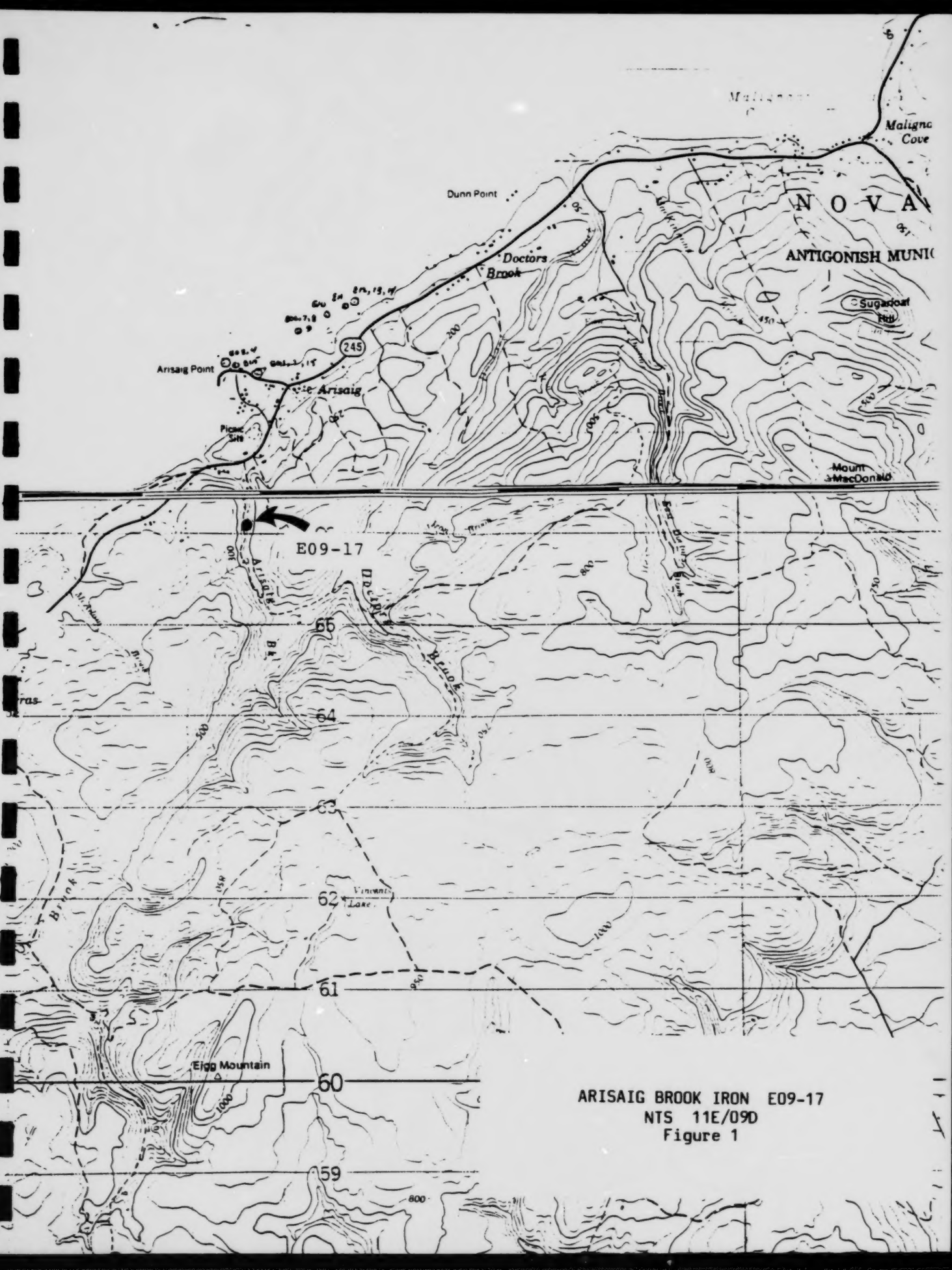
GENESIS:

This occurrence is of sedimentary origin.

TABLE 1

ARISAIG BROOK IRON OCCURRENCE SAMPLE DESCRIPTIONS

88 AB 701	Argillaceous siltstone, wallrock, east portal.
88 AB 702	Oolitic hematite, east portal.
88 AB 703	Oolitic hematite, west portal.



ARISAIG BROOK IRON E09-17
NTS 11E/09D
Figure 1

T20

TABLE 2
ARISAIG BROOK IRON ANALYSES

ARISAIG BROOK IRON Au + 33 (In ppm unless otherwise indicated)

83-A8	NaX	SX	CrX	FeX	Co	Ni	Zn	As	Se	Br	Rb	Zr	Mo	Ag	Cd	Sn
702	0.05	27.7	120	26.7	41	32	<100	5.7	<5	<2	13	560	3	<2	<5	<100
703	0.05	31.0	120	57.0	54	42	<100	0.4	<5	<2	16	720	2	<2	<5	130

ARISAIG BROOK IRON: ATOMIC ABSORPTION (In ppm unless otherwise indicated)

83-A8	Cu	Zn	Ag	Pb	Au ppb
702	3	88	<0.1	8	<5
703	1	70	0.1	8	<5

| | | |

SOUTH RIGHTS RIVER OCCURRENCE

OCCURRENCE: South Rights River E 09-20 (Anomalous Mo,Au). This change of name is recommended from "Silver Mine".

LOCATION 5056780 N 570160 E NTS 11E/09D

This is a corrected location from the 1988 Field Check but additional workings described by Fletcher have yet to be located.

ACCESS:

From the junction of Brierly Brook Back Road and Highway #245 north of Antigonish drive 0.9 km north on Highway #245 to Pleasant Valley road. Drive west on Pleasant Valley road for 1.25 km to point where the road branches. Take the north branch towards Pleasant Valley for 5 km to a branch road leading 0.73 km southwest to a gravel pit. At the north end of the gravel pit take the road leading west for 3.9 km to the south side of the loop (or 1.0 km from start of the loop). Walk 200 m, bearing approximately 180° to the shoulder of a bluff forming a small nose on the north side of South Rights River.

The pyritic zone of quartz-feldspar porphyry in metasediments is located just below the shoulder of the nose. Excavated surfaces and pyritization in the metasediments and pluton are fairly conspicuous. A small adit, not much more than a depression, is cut into the southeast corner of the outcrop area, approximately 45 m below the edge of the shoulder. The pyritic outcrop area measures approximately 26 m by 45 m. Additional workings have been reported but were not located during the field check, including those described by Fletcher.

REFERENCES:

Bourque, P. D., 1981. A Metallogenic Study of the Antigonish Highlands area, Nova Scotia, with Special Reference to the Copper Occurrences of the Ohio-Sylvan Glen belt. Unpublished M.Sc. Thesis, Dalhousie University, 420 pp.

Fletcher, 1893. Geological map, GSC Map 34 (388), scale 1" to 1 mile.

Murphy, J. B., 1982. Geology Map of the Antigonish Highlands, Nova Scotia. NSDME Map 82-5, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands, GSC Memoir.

NSDME AR 85-081 11E/09D Mike L. van Oirschot, 1985.
The South Rights River Volcanics, Northern Antigonish Highlands.

GEOLOGY:

The pyritic mineral occurrence is in Hadrynian Georgeville Group, South Rights Formation, which is composed predominantly of green-black mudstone and minor greywacke (Murphy, Keppie and Hynes, in press). At the mineral occurrence, the rocks are comprised of siltstone/shale metasediments with foliation 030°/75° to 85° SE. The metasediments are cut by pyritic polyphase porphyry intrusives:

(a) fine tan-green sericitic porphyritic (contaminated?) unit
(b) quartz-feldspar porphyry
(c) K-spar, quartz dykelets/crackle stockwork
(d) crackle-filled quartz veins of varied size orientation.

There are several generations of crackle brecciation and quartz infilling. Some were accompanied by pyrite mineralization.

Mineralization:
Mineralization consists of pyrite as irregular grains, aggregates of grains and abundant euhedral cubes. Pyrite is disseminated in all phases but is most abundant and coarsest with quartz veins in quartz-feldspar porphyries.

PREVIOUS WORK:

1979 Bourque reported the following from pyritic zone in South Rights River:
Pyrite 1.3-18.5%.
Cu and Zn background.
Ag < 1ppm.
Pb to 243 ppm.

1985 NSDME AR 85-081 A geological report by M.L. van Oirschot. No analytical values are provided.

FIELD CHECK, 1988 (Northcote and Armitage)

This occurrence is located some distance from the previous plotted locations on MOD cards and was found with direction provided by Stephen Cormier of Antigonish. The galena-bearing mineralization described by Fletcher (1893) was not located during this field check. The adit shown on Figure 2 by Oirschot (1985) was not field checked (there is no outcrop indicated on van Oirschot's map at the adit symbol).

A suite of 8 samples was taken for petrographic and major and minor chemical analyses. Table 1 gives a petrographic description of hand specimens and Table 2 the results of their chemical analyses. Samples were analyzed by Direct Irradiation/INAA for Au plus 33 additional elements and for Cu, Zn, Pb, and Ag by Atomic Absorption methods. Gold values were checked using a combination of Fire Assay/Atomic Absorption methods.

RESULTS:

Table 2 indicates that none of the samples gave metal values of economic significance. Mo values are slightly anomalous, ranging up to 34 ppm. Gold values are also slightly anomalous ranging from 16 to 24 ppb by neutron activation and 7 to 14 ppb by fire assay-atomic absorption methods. Sample 88 sm 604 gave a maximum value for lead of 86 ppm.

SIGNIFICANCE:

The geologic environment is one of emplacement of differentiated plutonic phases in metasediments accompanied by silica, sericite alteration and iron sulphide mineralization. There were several episodes of brecciation, some of which were accompanied by silicification resulting in quartz-filled stockworks. Some silicification was accompanied by additional sulphide mineralization.

Mineralization at South Rights River is of metallogenic significance. Although economic mineralization was not evident in the cursory examination of this mineral occurrence, the geologic environment is favourable for generation of base and precious metal disseminated and vein type mineral deposits.

AGE:

Mineralization is probably related to late stages of the plutonic events. If so, it is approximately the same age as the plutons.

TABLE 1

SOUTH RIGHTS RIVER SAMPLE DESCRIPTIONS

88-SM-601
Argillaceous siltstone/very fine sandy texture. Fine disseminated sulphides. Open space quartz crackle fracture filling.

88-SM-602
Silty shale, mottled medium/dark grey-green and tan-green, iron-stained. Irregularly contorted soft sediment deformation of laminations and silty partings/lensoids in lamination planes.

88-SM-603
Quartz porphyry with rounded quartz phenocrysts in a feldspathic matrix and irregular coarse quartz segregations. Late crackle brecciation. Iron-stained, clusters of coarse hematite grains, disseminated pyrite.

88-SM-603 A
Deformed quartz porphyry. Sericite, chlorite-rich matrix. Brecciated, filled by anastomosing, irregular (contorted?) open space quartz veinlets. Weak iron-staining. Clusters of hematite grains.

88-SM-603 B
Quartz porphyry, irregular but rounded coarse-grained quartz in a very fine feldspathic, chloritic, sericitic matrix. Abundant (>5%) pyrite as disseminations and in hairline fractures.

88-SM-603 C
Quartz-feldspar porphyry, crackle brecciation, healed by a network ofchlorite. Fine disseminated pyrite and aggregates of pyrite grains.

88-SM-604 A
Quartz-feldspar porphyry, crushed and later healed by chlorite-sericite. Disseminated fine pyrite and as clusters of grains. Gash veins and open space infillings of iron-stained quartz, feldspar(?), containing pods of clusters of coarser pyrite.

88-SM-604 B
Brecciated, (crushed), altered quartz-feldspar porphyry. Veined by massive quartz which has also been brecciated. Chlorite segregations form lensoids. Multipe generations of quartz. Some open space quartz veinlets with associated clusters of coarse pyrite crystals.

88-SM-605
Quartz feldspar porphyry. Two phases.

(a) medium grey green, medium-grained quartz and feldspar phenocrysts in a finer feldspar-chlorite-sericite matrix.

Cut by:
(b) light cream buff feldspar porphyry, leucocratic, rounded quartz and euhedral plagioclase laths in a finer siliceous-feldspathic matrix.

Both phases are cut by small open space quartz veinlets. Late crackle brecciation. Disseminated pyrite throughout.

88-SM-806

Deformed siltstone/fine sandstone, chert pebble conglomerate, foliation by deformation, abundant fragments and lensoids of lithic, siliceous (cherty) material, some >1 cm in a matrix of finer lithic material of same composition and quartz and feldspar(?) grains.

Cut by quartz veinlets and lensoids ± along foliation plane. Crosscut by later quartz veinlets. Late crushing.

Contains weathered, altered fragments? with a feldspathic, siliceous, weathered out drusy clay-like matrix. Iron-stained, limonitic lensoids. Disseminated pyrite.

88-SM-807

Shale/argillite, foliated, dark grey-green, chloritic, with silty laminations/lensoids. Interbedded with cherty breccia/pebble conglomerate. Weak disseminated pyrite.

88-SM-808

Quartz-feldspar porphyry, coarse rounded quartz phenocrysts (resorbed?) in a very fine/aphanitic, orange-cream, feldspathic matrix.

Several generations of crackle brecciation with at least three generations of open space, drusy, and hairline quartz infilling. Pyrite with associated iron-staining.

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TABLE 2
SILVER MINE ANALY

SILVER MINE Au + 33

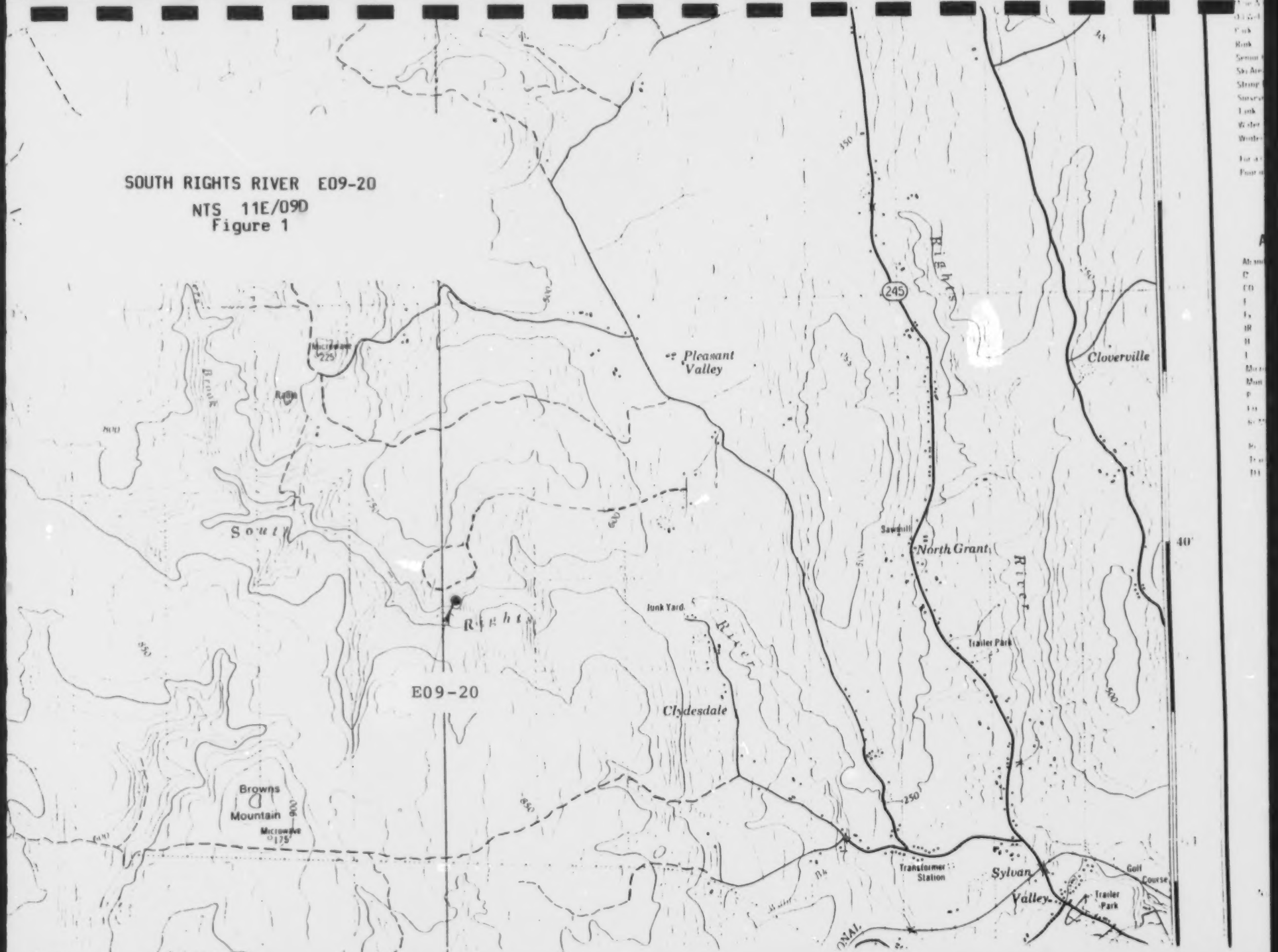
80-SM	MoX	Sc	Cr	Fe%	Co	Ni	Cu	Zn	As	Br	Rb	Sr	Mo	Ag	Cd	Sn	Sb
603	0.11	6.3	100	3.2	30	200	85	200	8	7	280	150	28	2	0	<100	0.9
604	0.16	9.4	100	3.2	30	200	85	200	8	7	280	150	28	2	0	<100	0.6
605	0.15	9.4	100	3.2	30	200	85	200	8	7	280	150	28	2	0	<100	0.6
606	0.12	8.4	170	3.2	30	200	85	200	8	7	280	150	28	2	0	<100	0.6
607	0.17	10	210	3.2	30	200	85	200	8	7	280	150	28	2	0	<100	0.7
608	0.14	4.2	230	1.2	30	200	85	200	8	7	280	150	28	2	0	<100	0.6

SILVERMINE ATOMIC ABSORPTION

80-SM	Cu	Zn	Ag	Pb	Au ppb
603	5	22	0.1	4	9
604	5	150	0.4	86	9
605	5	14	0.3	11	7
606	5	5	0.4	7	17
607	5	30	0.2	14	18
608	5	8	0.3	8	14

TABLE 2

LVER MINE ANALYSES


SOUTH RIGHTS RIVER E09-20
NTS 11E/09D
Figure 1
E09-20
Pleasant Valley
Cloverville
North Grant
Clydesdale
Sylvan Valley
Browns Mountain
Microwave
Transformer Station
Golf Course
Trailer Park
Junk Yard
Sawmill
245
250
Rights
River
South
Right
Creek
Canal

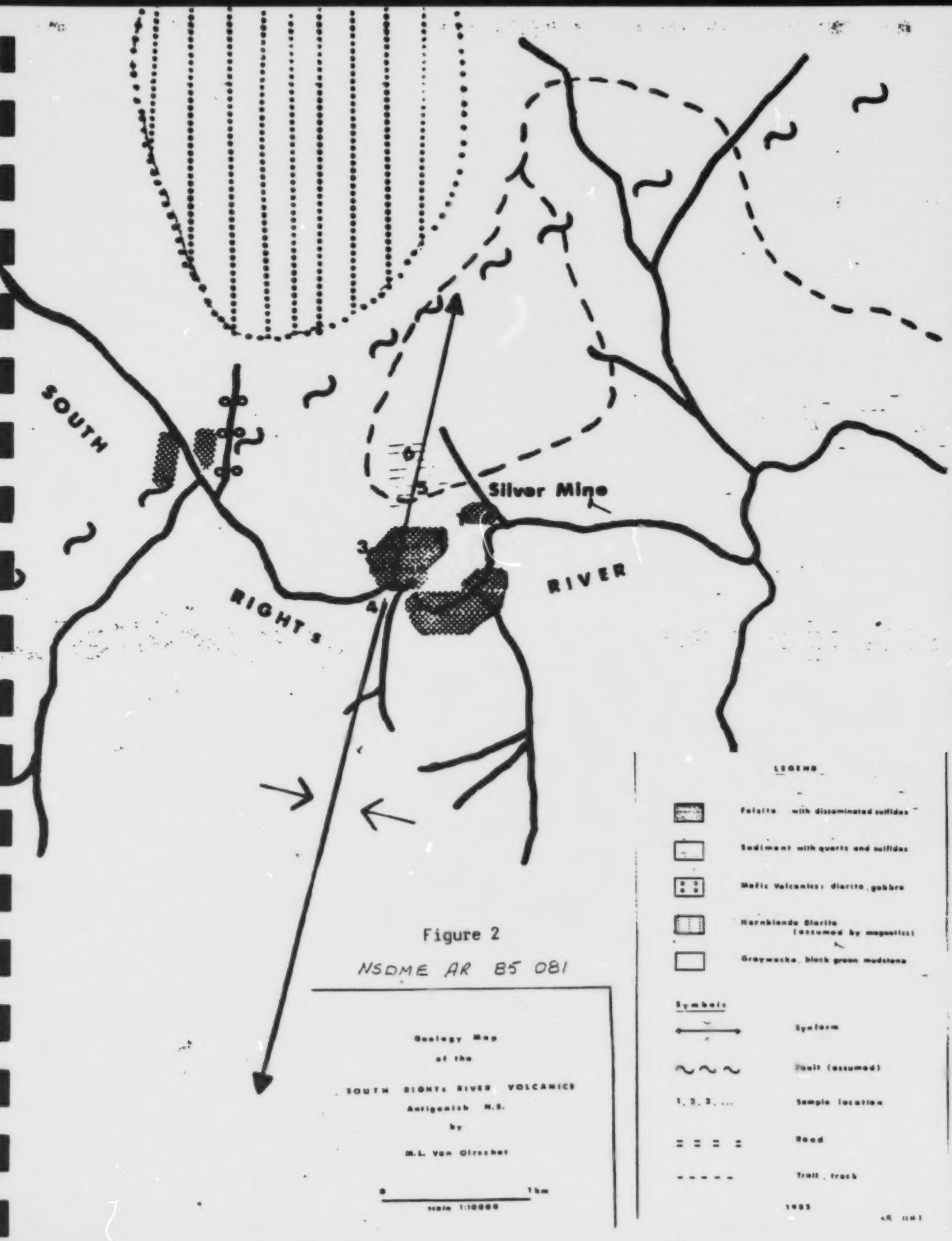


Figure 2

NSDME AR 85 081

DOCTORS BROOK

OCCURRENCE: **DOCTORS BROOK E09-22**
Traces of chalcopyrite, hardly sufficient to be considered an occurrence.

LOCATION: **5063620 N** **567100 E** **NTS 11E/9D**
No single occurrence. Widely scattered traces of chalcopyrite are associated with quartz veining along a traverse length of 200 m up the stream.

ACCESS:
Drive up MacDonald Road at Arisaig for 3.1 km to the point where the road branches. Go by foot up the Doctors Brook branch for 2 km, past two side streams entering from the east. At 2 km the creek branches, small branch to west (right) main branch to left (south). Follow the main branch for 500 m to point where the stream branches again (south and east) and continue along main branch (south) for another 50 m. Widely spaced quartz veins with traces of chalcopyrite occur in metasedimentary bedrock and float over the next 200+ m (Fig. 1).

REFERENCES:
NSDME AR 11E/09D 07-B-12 (01) Noranda Exploration Company Limited.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., 1983. Geology map of the northern Antigonish Highlands, Nova Scotia. NSDME Map 82-5, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands, GSC Memoir.

GEOLOGIC SETTING: (NSDME AR; Murphy et al., in press).
The property is underlain by metasediments of Precambrian age Maple Ridge Formation of the Georgeville Group. The main rock type is metasedimentary, consisting of argillite and siltstone with occasional coarser beds. A gabbro plug has intruded the sediments to the northwest and may be the plutonic equivalent of green mafic flows which outcrop farther to the north and south.

The environment of deposition is one of slumped and regular turbidites (Murphy et al., in press).

GEOLOGY OF THE "OCCURRENCE" (Northcote and Armitage, Field Check 1988)
The area of the "occurrence" is underlain mainly by chloritic (micaceous) hornfelsed silty to fine sandy argillite with attitude of bedding (and foliation) averaging 070°-080°/45°-80° S. These metasedimentary rocks are cut by quartz veins and a number of small crackle gash veins which are visible in outcrop and in stream boulders. Most veins range from a fraction of a cm to several cm wide, are branching and have random orientations. Above 500 m upstream veining in float increases in abundance, and in width up to 1 m.

Most of the veins are of white bull quartz but many contain zones along their margins and later veinlets of clear vitreous quartz with open space filling. In some places quartz with epidote impregnates the wall rock.

PREVIOUS WORK:
1980 NSDME AR 11E/09D 07-B-12 (01) Noranda Exploration Company Limited. Detailed silt sampling (Cu, Pb, Zn, Ag, Ni), prospecting, spectrometer survey.

The silt geochemical survey uncovered a Pb anomaly. Follow-up prospecting resulted in discovery of widely scattered chalcopyrite blebs in quartz veins cutting the metasedimentary rocks. The Pb anomaly was not explained (Fig. 2).

RESULTS OF THE 1988 FIELD CHECK: (Northcote and Armitage)

Extensive chipping along the length of the traverse resulted in traces of chalcopyrite being found in a few widespread locations in the vicinity of the reported occurrence. The chalcopyrite occurs with vitreous quartz at vein contacts with wall rock. Traces of disseminated chalcopyrite with pyrite were also found in the metasedimentary rock.

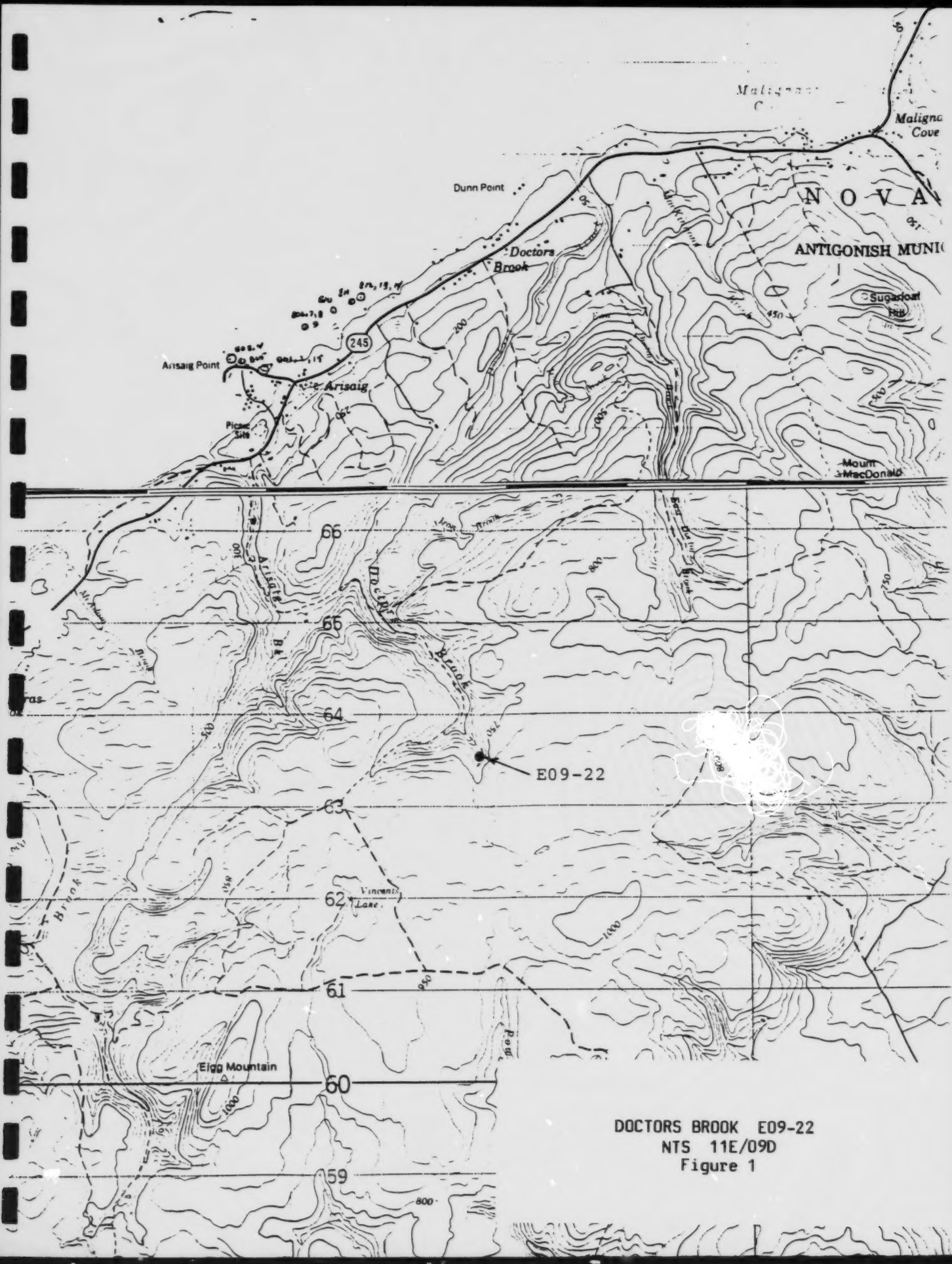
Three samples were collected for study (Table 1). However, only one sample, 88 DB 1402, was sent for analysis for Au + 33 additional elements by Direct Irradiation/INAA and Cu, Pb, Zn, Ag by Atomic Absorption and Au by Fire Assay/Atomic Absorption methods. The results of these analyses are given in Table 2 and indicate nothing of economic significance.

SIGNIFICANCE:

The mineralization observed in this field check is not of economic or metallogenic significance. Anomalous Pb values reported by Noranda in the geochemical silt survey have not been explained.

TABLE 1
DOCTORS BROOK SAMPLE DESCRIPTIONS

Sample #	Lithology	Mineralization	Type
88 DB 1401	Chloritic interbedded siltstone and shale (500 m upstream)	Trace disseminated pyrite and chalcopyrite	Chip
88 DB 1402	Quartz vein (700 m upstream)	Trace chalcopyrite	Chip
88 DB 1403	Chloritic siltstone and shale and quartz (500 m upstream)	N.D.	Chip



DOCTORS BROOK E09-22
NTS 11E/09D
Figure 1

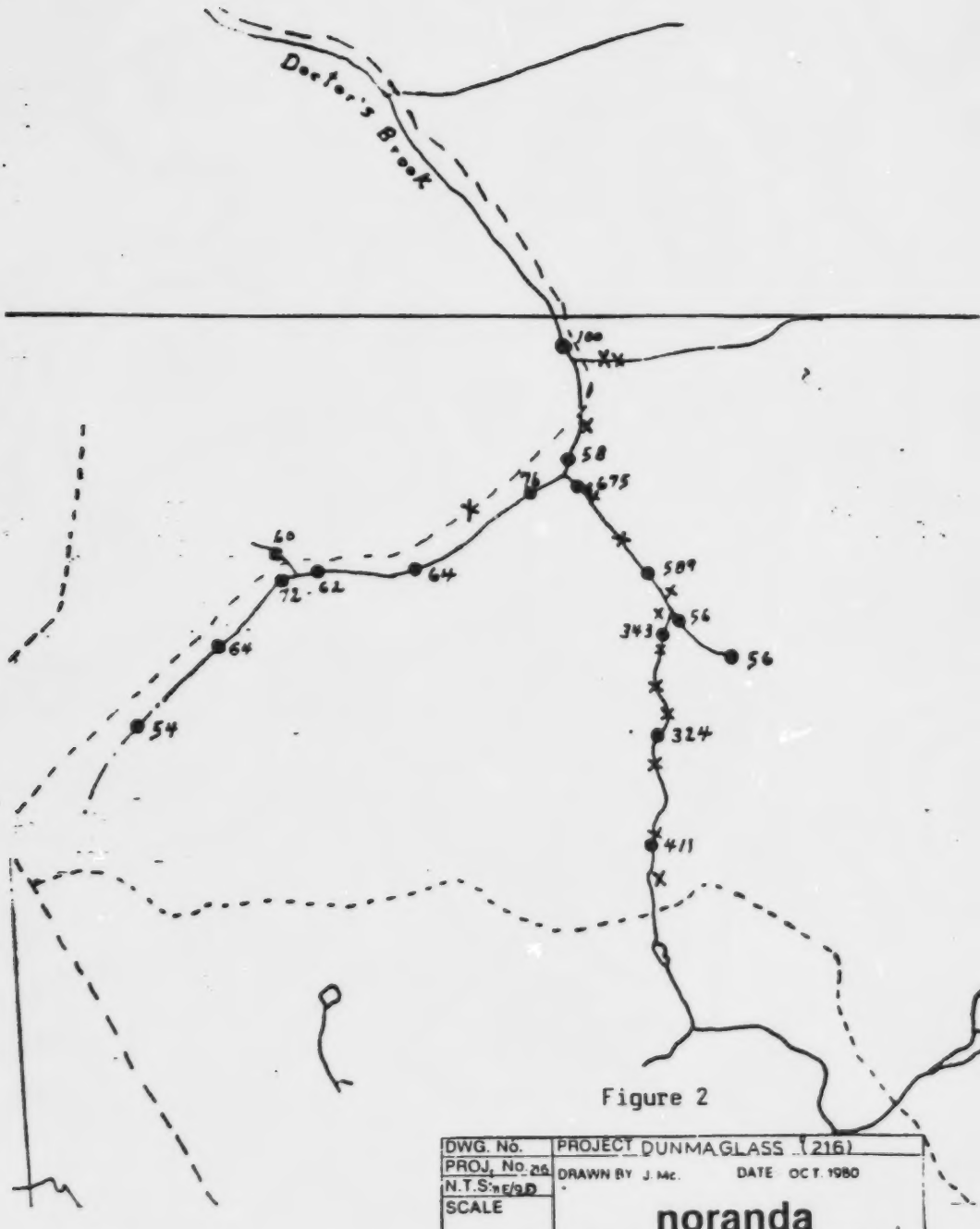


Figure 2

DWG. No.	PROJECT DUNMAGLASS (216)
PROJ. No. 216	DRAWN BY J. Mc. DATE OCT. 1980
N.T.S. 11E/9D	
SCALE	noranda
	Noranda Exploration Co. Ltd. - Bathurst, N.B.
REVISED	GEOCHEMISTRY SILTS LEAD

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TABLE 2
DOCTORS BROOK SAMPLE ANALYSES

DOCTORS BROOK: Au +33 (ppm unless otherwise indicated)

88-DB	NaX	Sc	Cr	FeX	Co	Ni	Zn	As	Se	Br	Rb	Zr	Mo	Ag	Cd	Sn	Sb	Ta	Cs	Ba	La	Ce	Sm	Eu	Tb	Yb	Lu	Hf	Ta	W	Ir	Au ppb	Th	U	WT
1402	0.58	2.1	350	1	<5	<20	<100	4.5	<5	<2	28	<200	2	<2	<5	<100	0.2	<10	0.6	150	5	4	1.2	<1	<0.5	<2	<0.2	1	<0.5	<1	<50	5	1.4	0.5	41.93

DOCTORS BROOK: ATOMIC ABSORPTION (ppm unless otherwise indicated)

88-DB	Cu	Zn	Ag	Pb	Au ppb
1402	241	15	0.1	3	<5

McIVER/MIDDLE BROOK PYRITIC ZONE

OCCURRENCE: McIVER/MIDDLE BROOK E09-26 (Pyrite)

LOCATION: 5047890 N 557550 E NTS 11E/09B

ACCESS:

From Highway 104 at Barneys River Station, turn south on Highway 4 and drive 0.4 km to Weaver Mountain road which accesses the east side of McIver Brook. Turn southeast on Weaver Mountain road and drive for 2.3 km to a branch road leading west to Middle Brook. Iron-stained outcrops and subcrops occur on both sides of the Middle Brook access road starting about 0.7 km from its junction with Weaver Mountain road.

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands, GSC Memoir.

GEOLOGIC ENVIRONMENT:

The pyritic, hydrothermal alteration zone occurs in the upper member of the Beechill Cove (S_{Bb}) metasediments just to the west of a contact with Bears Brook (O_B) sediments and approximately 1 km north of the Browns Mountain Fault (Murphy, 1986).

The upper member of the Beechill Cove consists of massive, blue-green, muscovite-bearing siltstone which is abundantly fossiliferous (brachiopods, trilobites, crinoids and corals). The siltstones are laterally continuous and display sharp basal contacts. The Beachill Cove sediments were deposited as a transgressive sequence during progressive submergence (Murphy et al., in press).

The rocks have been regionally metamorphosed to lower greenschist facies grade and have subsequently been intruded by quartz-rich "dacitic" dykes spatially associated with strong sericite, quartz and lesser epidote zones abundantly mineralized by disseminated pyrite (to 10%). In addition, the metasedimentary sequence is cut by widely spaced, irregular, open space quartz veins and veinlets.

The metasedimentary rocks are bedded/foliated with fairly consistent attitudes of 070°-080°/60°-70° NW.

Petrographic description:

In thin section the metasiltstone/shale is composed primarily of quartz and lesser feldspar showing swirls and lobate structures of soft sediment deformation. The feldspar is altered to varied degrees to sericite and the matrix is chloritic, sericitic with lesser carbonate. The sediments contain weakly disseminated pyrite. There is no evidence of K-spar in stained slabs.

The dyke rock is of quartz-rich dacitic composition, porphyritic to seriate, with sericitic plagioclase, conspicuous interstitial quartz, mafics altered to chlorite and sericite, and has approximately 5% disseminated pyrite. There is no evidence of K-spar in the dyke-rock.

The strong hydrothermally altered metasediments associated with the dykes show ghost-like outlines of granular sericitized plagioclase and clusters of anhedral

irregular quartz grains in a strong sericitic network. There is no evidence of K-feldspar in stained slabs.

The hydrothermally altered-metasediments are mineralized with 5 to 10% disseminated pyrite which contains minute blebs of chalcopyrite, pyrrhotite, sphalerite and a pale cream-green unknown mineral.

RESULTS OF 1986 FIELD CHECK (Northcote)

A suite of 11 samples, representing quartz veins, relatively unaltered metasediments, mineralized dyke rock, and hydrothermally altered, mineralized wall rock, was taken for petrographic and major and trace element analyses. Samples were analyzed, at Bondar Clegg Laboratory, Ottawa, for Au + 33 additional elements by Direct Irradiation/IRAA, for Mg, Mn, Rb, Nb, Ba, Ta by DC plasma and by Atomic Absorption for 15 elements and a combination of Fire Assay/Atomic Absorption for Au. A summary of petrographic analyses is given in Table 1 and analytical results are listed in Table 2.

Analyses of pyritic dyke and hydrothermally-altered pyritic wall rocks show weakly anomalous values for Au (12 to 44 ppb), Zn (to 157 ppm; 230 ppm in the dyke) and Cu (77 ppm in the dyke).

SIGNIFICANCE:

The dacite dykes and associated alteration may, as suggested by Murphy et al. (in press), be related to major faulting (Browns Mountain Fault).

The pyritic zone and associated hydrothermal alteration, although revealing nothing of economic importance in this cursory examination, remains of metallogenic significance.

TABLE 1
McIVER/MIDDLE BROOK SAMPLE DESCRIPTIONS

Sample #	Lithology	Hydrothermal alteration	Mineralization	Type
86McIV-1	Quartz veins	Quartz	None visible	Chip
86McIV-2	Silty shale	None	Weakly dissem pyr	Chip
86McIV-3	Silty shale/siltstone	None	Very fine diss pyr Richer in darker matrix	Chip
86McIV-4	Silty shale	Sericite, chlorite	Sparse diss v.f. pyrite	Chip
86McIV-5	Porphyritic dacite	Sericite, quartz	5%+ diss euhedral pyrite	Chip
86McIV-6	Hydrothermal alt sed	Quartz, sericite network	5% subhed/irreg pyrite	Chip
86McIV-7	Hydrothermal alt sed	Sericite	Pyrite, with chalcopyrite and sphalerite blebs	Chip
86McIV-8	Hydrothermal alt sed	Strong sericitic matrix	Strong disseminated pyrite	Chip
86McIV-9	Altered graywacke	Strong sericite	10% diss pyr with blebs of pyrrhotite, chalcopyrite, trace of sphalerite	Chip
86/McIV-10	Altered graywacke	Strong sericitic	<5% pyrite, minor hematite Sphalerite and pyrrhotite blebs in pyrite	Chip
86/McIV-11	Metasandstone	Sericite alteration of feldspars; chlorite and carbonate in matrix.	Weak disseminated pyrite	Chip

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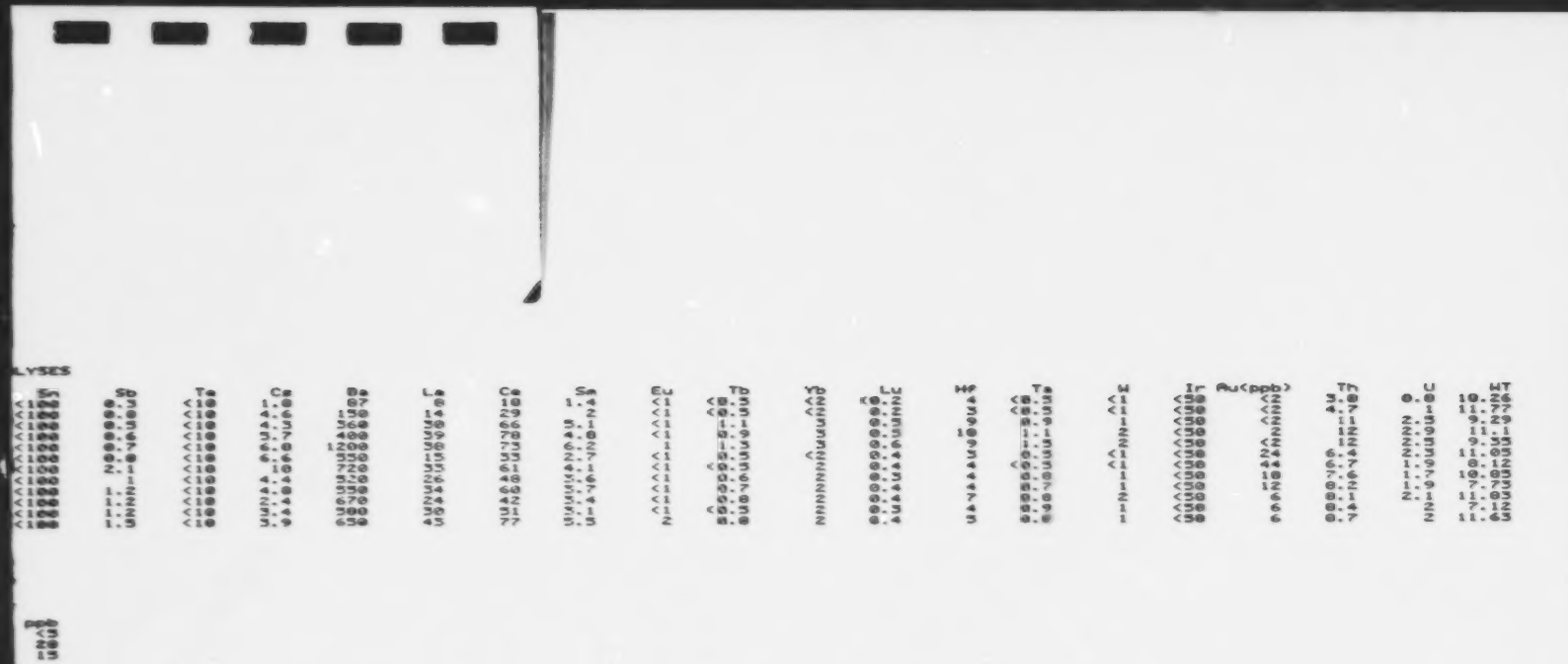
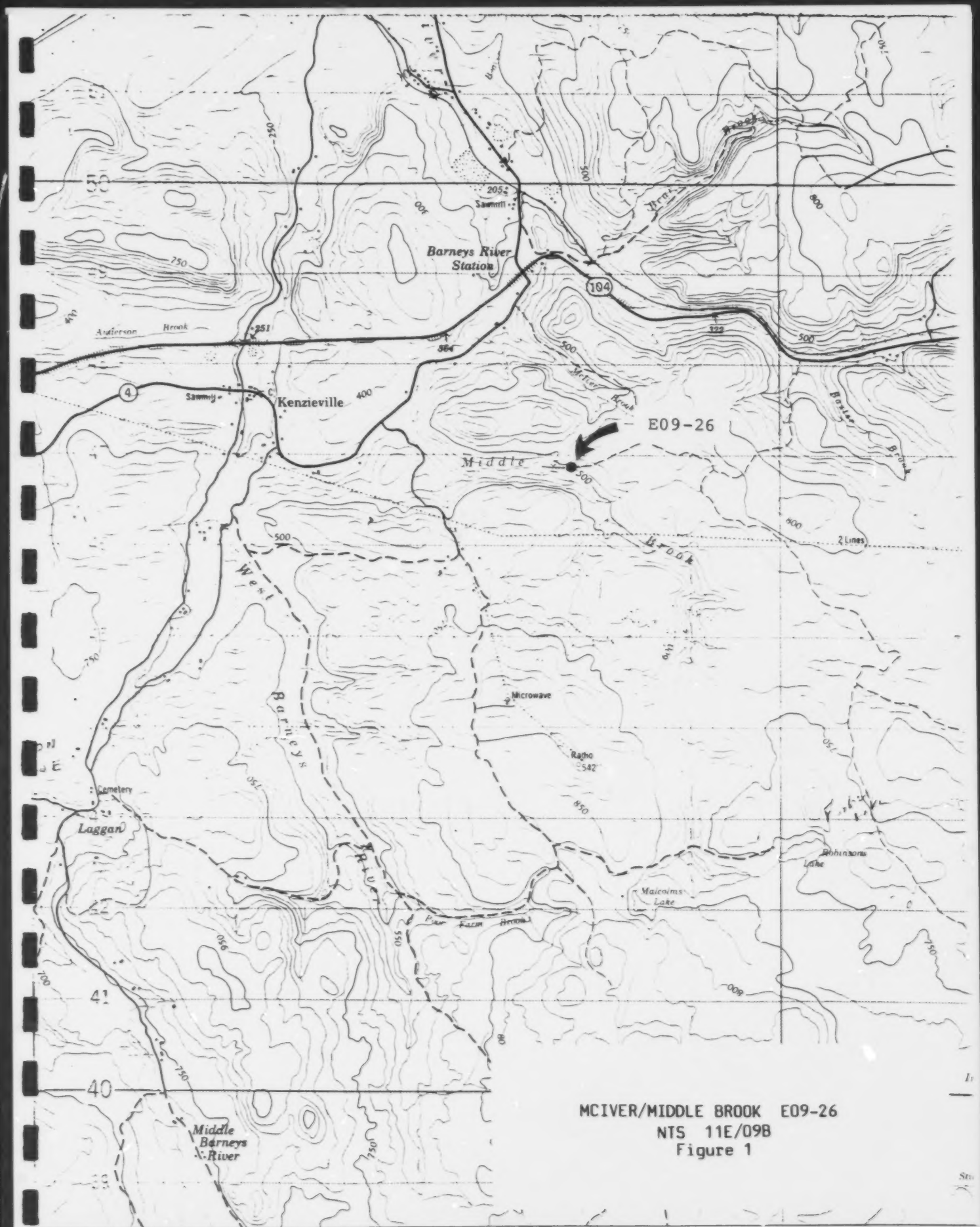
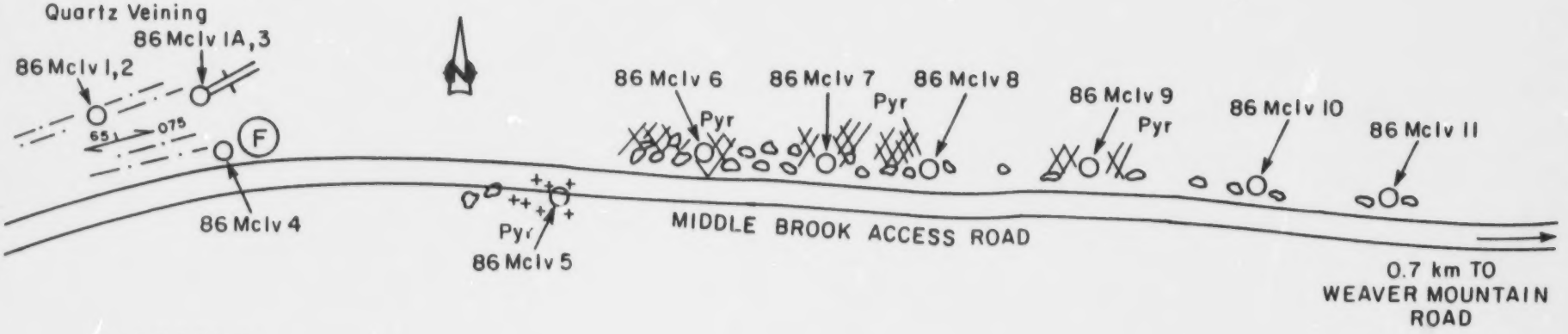
TABLE 2
McIVER/MIDDLE BROOK ANALYSES

| McIVER/MIDDLE BROOK: Au + 33 | | |





MCIVER/MIDDLE BROOK E09-26
NTS 11E/09B
Figure 1



LEGEND

- Siltstone/greywacke
- Quartz diorite/dacite
- Subcrop metasediment rubble
- Hydrothermal alteration
- Quartz veins
- 180 Foliation
- F Fossil

McIVER-MIDDLE BROOK
PYRITIC ZONE

SAMPLE LOCATIONS

0 20 40 60 80 100
metres

Nov.11/'86 K.E.N.

Figure 2

WOODFIELD #1

OCCURRENCE: WOODFIELD #1 (Pyrite)

LOCATION: 5040310 N 546360 E NTS 11E/9B

ACCESS:

Drive west on the Woodfield-North Meiklefield road for 1 km to a point where a small access road branches to the south. Iron staining in outcrops occur on the north side of the main road at this point.

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

GEOLOGY: (Murphy et al., in press)

This minor pyritic occurrence is underlain by Hadrynian, Moose River Member of the Keppoch Formation (Murphy, 1986). The Moose River Member is distinguished from the underlying Frasers Brook Member by finely laminated mudstone interlayered with the volcanic rock. The contact with the overlying James River Formation is placed where volcanic rock is volumetrically minor. Felsic rocks are massive and pale green and consist of ignimbrite, tuff, flows and basaltic andesite flows.

Finely laminated mudstone occurs only in the Moose River Member. The mudstones consists of fine-grained subangular to subrounded quartz, albite and minor pyrite in a matrix dominated by sericite, chlorite and minor biotite, which define a weak cleavage, generally at a small angle to bedding. Coarser units display graded bedding.

The Moose River Member was probably deposited in a submarine environment because the mudstones are inferred to have been deposited by turbidity currents.

STRUCTURE:

The Woodfield #1 pyritic occurrence is located on the south side of the Browns Mountain fault and the foliation and mineralization may be genetically related to that structure.

RESULTS OF 1988 FIELD CHECK (Northcote and Armitage)

Geological Description:

Pyritic Zone:

The pyritic zone is a subcrop of schistose, foliated, micaceous, quartzose metasediment with quartz eyes in the plane of foliation. There are minor amounts of disseminated fine pyrite crystals. The rock has iron stained spots and abundantly stained fracture surfaces. Scattered quartz sweats(?) contain chlorite segregations and open cavities.

Two samples were taken for Direct Irradiation/INAA Au + 33 analyses and Atomic Absorption for Cu, Zn, Ag, Pb, and Au.

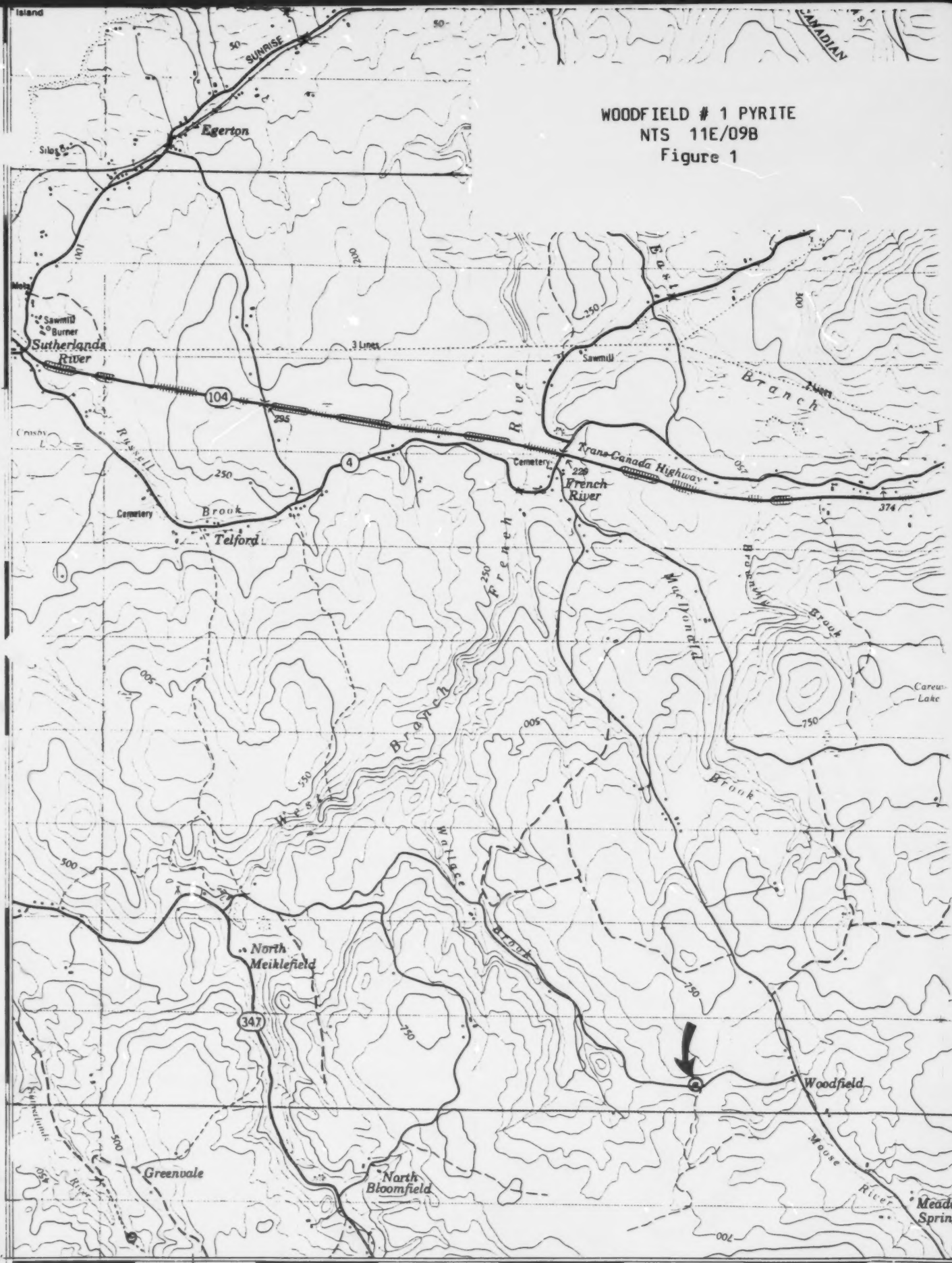
TABLE 1

WOODFIELD #1 SAMPLES

Sample #	Lithology	Mineralization	Sample Type
88 WF 901	Quartz, chlorite, sericite schist	Pyrite, iron stained	Chip
88 WF 902	Quartz, crackled, chlorite blebs, coarse sericite, schistose frags.	----------	Chip

Results of analyses are listed in Table 2 and show anomalous values for Zr of 2500 ppm, and weakly anomalous values for Au of 14 ppb (9 ppb). Maximum Fe value is 3.7%.

WOODFIELD # 1 PYRITE
NTS 11E/09B
Figure 1



62°30' 25' 48 49

T24

TABLE 2
WOODFIELD PYRITE #1 ZONE ANALYSES

| WOODFIELD 88-WF | (pyrite #1) | Au + 33 | | |

WOODFIELD #2

OCCURRENCE: WOODFIELD #2 (Pyrite)

LOCATION: 5039000 N 546300 E NTS 11E/9B

ACCESS:

Drive west on the Woodfield - North Meiklefield road for 1 km to a point where a small access road branches to the south. Follow this road south for approximately 1.5 km. Iron-stained outcrop is visible on the southeast side of the road. Access is gated by W. E. Fraser.

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

GEOLOGY: (Murphy et al., in press)

The Woodfield #2 pyritic zone is underlain by the Silurian Ross Brook Formation and is located a few hundred metres south of a major fault south of and paralleling the Browns Mountain fault.

RESULTS OF 1988 FIELD CHECK (Northcote and Armitage)

The Woodfield #2 pyritic zone consists of foliated to schistose (085°/70° N) quartzose very fine-grained sandstone/siltstone/quartz pebble-bearing quartzose sandstone in a sericitic (phyllitic) foliated matrix. The presence of sandstone suggests that this occurrence is in the upper Member of the Ross Brook (Murphy, Keppie and Hynes, in press). At this locality the sequence is cut by a dyke (Murphy, 1986) and by irregular fairly closely spaced veinlets following foliation.

Limonite pseudomorphs after euhedral pyrite are disseminated through the wallrock matrix and in weathered-out pits. The veinlets are composed of white quartz with chloritic clots and are not obviously mineralized.

Pyrite mineralization may be a result of structure (middle to late Devonian) or associated with dykes of unknown age.

Two samples were taken for analyses.

TABLE 1

WOODFIELD #2 PYRITIC ZONE

88-WF-1201	Vein and country rock. Brecciated quartz and segregations of white quartz and chlorite. Wall rock fragments of siltstone and quartz pebble bearing quartzose sandstone.
88-WF-1202	Foliated/schistose quartose very fine grained sandstone/siltstone. Sericite in foliation planes. Limonite pseudomorphous after pyrite. Iron-stained.

Sample 88-WF-1201 containing quartz and country rock was analysed by Direct Irradiation/INAA for Au plus 33 additional elements and by Atomic Absorption for Cu, Pb, Zn, Ag, and for Au by Fire Assay/ Atomic Absorption. The results of the analyses are listed in Table 2.

The analyses indicated nothing of economic significance but do show anomalous Zr at 1100 ppm, very weak Au at 14 and 7 ppb, and Mo at 9 ppm.

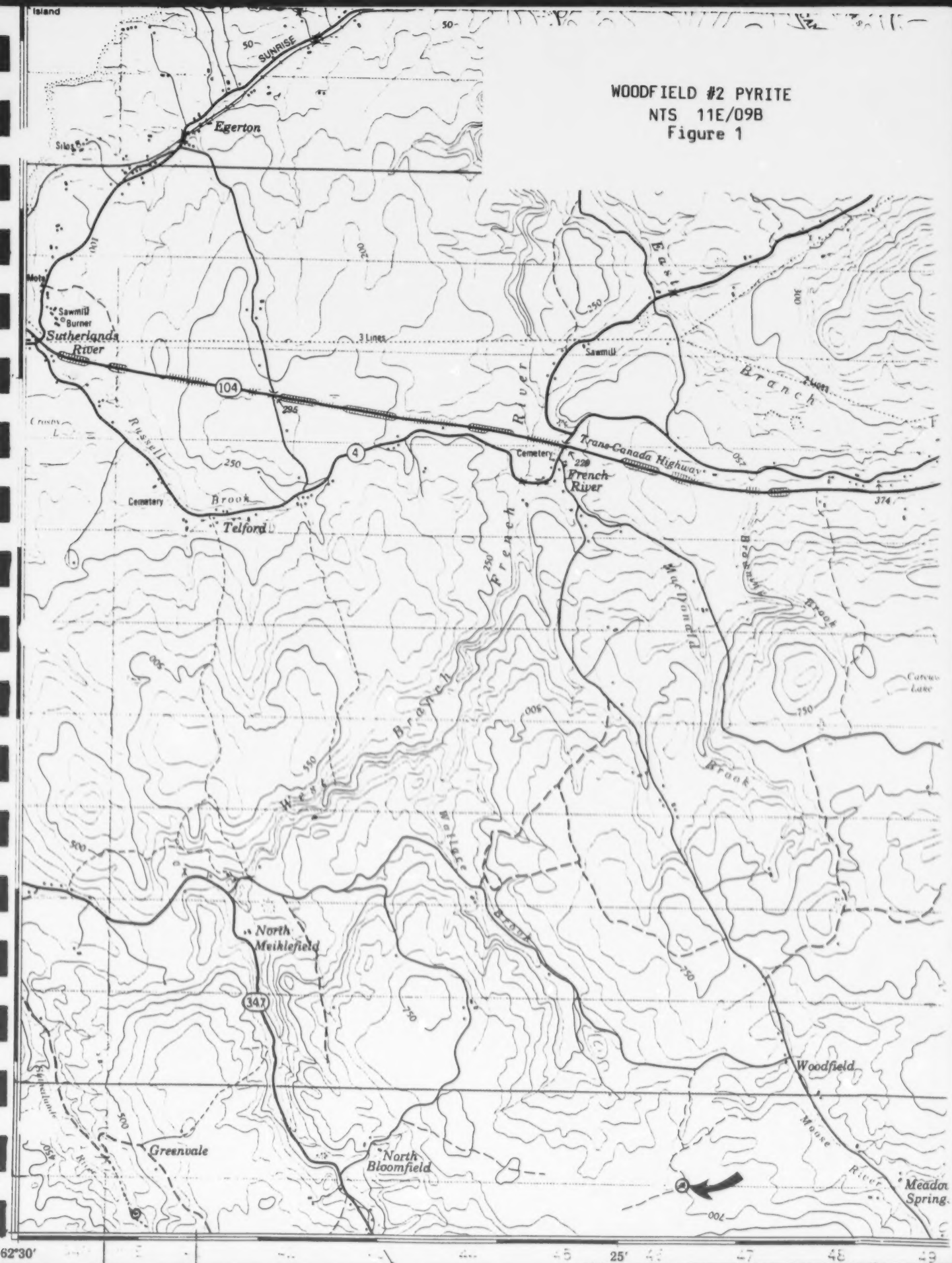
725

TABLE 2
WOODFIELD PYRITE #2 ANALYSES

WOODFIELD	(Pyrite #2)		Au + 33																																				
88-WF	NaX		Sc		Cr		FeX		Co		Ni		Zn		As		Se		Br		Rb		Zr		Mo		Ag		Cd		Sn		Sb		Ts		Cs		Ba
1201	0.65		0.7		248		4.1		15		<28		<188		29		25		72		58		1186		9		72		25		<180		0.7		13		1.5		74
WOODFIELD	(Pyrite #2)		ATOMIC ABSORPTION																																				
88-WF	Cu		Zn		Ag		Pb		Au ppb																														
1201	13		65		0.1		6																																

WOODFIELD	(Pyrite #2)																																						
88-WF	La		Ce		Nd		Sm		Eu		Tb		Yb		Lu		Hf		Ta		W		Ir		Au ppb		Th		U		Mt								
1201	68		188		21.2		21		4		8		1.2		26		5.8		1		<50		14		12		3.4		39.55								

WOODFIELD #2 PYRITE
NTS 11E/09B
Figure 1



WALLACE BROOK

OCCURRENCE: WALLACE BROOK (Pyrite)

LOCATION: 5041650 N 544500 E NTS 11E/09B

ACCESS:

Drive west on the Woodfield-North Meiklefield road for 3.5 km. Pyritic outcrop occurs on the north side of the road following the north bank of Wallace Brook. The outcrop area is about 0.75 km southeast of a branching access road system leading northeast from Wallace Brook.

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

GEOLOGY: (Murphy et al., in press)

This pyritic, iron-stained zone is in Hadrynian Georgeville Group, undivided James River Formation (Murphy, 1986). In the Keppoch block the James River Formation is composed of wackes, siltstones and shales, lacking the conglomerates characteristic of the lower James River Member in the Maple Ridge and Clydesdale blocks. Deposition is thought to have occurred in a turbidite inner/middle fan environment (Murphy et el., in press).

RESULTS OF 1988 FIELD CHECK (Northcote and Armitage)

This was a cursory examination of pyritic zones reported by Murphy, 1986. The pyritic zone occurs in foliated metasediments cut by chloritic dykes(?) of basic/intermediate composition. On the east side of the outcrop area there are phyllitic schists; at the road curve there are greywacke, conglomerate, siltstone and dykes(?). A mottled appearance suggests a fragmental nature with chlorite and epidote alteration.

TABLE 1

WALLACE BROOK SAMPLES

88-WB-1001	Metasediment, siltstone to very fine wacke, foliated, some disseminated pyrite. Hematite in fractures.
88-WB-1002	Metasediment, siltstone/argillaceous siltstone, lithic and mineral fragments, swirled fabric, soft sediment deformation. Hematite-filling hairline fractures.

Andesite/basalt, very fine-grained, chloritic, massive but crackled with epidote fracture-filling (network). Disseminated pyrite. Iron-staining.

Sample 88-WB-1001 was sent for Direct Irradiation/INAA Au plus 33 additional elements, and Atomic Absorption analyses for a total of 36 elements with some duplication by the two methods.

The analyses showed nothing of economic interest.

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TABLE 2
WALLACE BROOK PYRITE #3 ANALYSES

WALLACE BROOK (pyrite #3) Au + 35																																							
88-WB	NaX	Sc	Cr	FeX	Co	Ni	Zn	As	Se	Br	Rb	Zr	Mo	Ag	Cd	Sn	Sb	Te	Cs	Ba	La	Ce	Sm	Eu	Yb	Yb	Lu	Hf	Ta	W	Ir	Au ppb	Th	U	WT				
1001	2.6	10	140	7.5	25	<20	150	10	<5	<2	65	<200	5	<2	<5	<100	0.8	<10	1.4	740	51	60	9.4	5	1.4	5	0.5	6	1.6	<1	<30	6	5.2	1.2	44.36				
WALLACE BROOK (pyrite #3) ATOMIC ABSORPTION																																							
88-WB	Cu	Zn	Ag	Pb	Au																																		
1001	25	70	<0.1	3	<3																																		

WALLACE BROOK PYRITE
NTS 11E/09B
Figure 1
Egerton
Sutherlands River
Sawmill
Burner
3 Lines
104
Trans-Canada Highway
Telford
French River
Cemetery
Sawmill
Branch
River
East
Brook
Wallace
Wallace Brook
North Meiklefield
347
Greenvale
North Bloomfield
Woodfield
Moose River
Meadow Spring
Carew Lake
Sutherlands River
Crosby L.
Island
SUNRISE
Silas R.
Motel
Cemetery
Brook
Branch
Brook
Brook
Brook

GREENVALE/SUTHERLANDS RIVER

OCCURRENCE: GREENVALE/SUTHERLANDS RIVER (Pyrite)

LOCATION: 5039300 N 539920 E NTS 11E/09B

ACCESS:

From McPhersons Mills, drive 2.0 km southwesterly on Highway #347 to a branch road leading to Sutherlands River. Take the Sutherlands River branch road to the junction then turn left (southeast) and follow road toward Greenvale for 2.75 km to the south curve in an "S" curve. Iron-stained outcrop (subcrop) occurs along the east side of the road just before the start of the curve.

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands, GSC Memoir.

GEOLOGY: (Murphy et al., in press)

This minor pyritic occurrence is underlain by the Hadrynian, Moose River Member of the Keppoch Formation (Murphy, 1986). The Moose River Member is distinguished from the underlying Frasers Brook Member by finely laminated mudstone interlayered with the volcanic rock. The contact with the overlying James River Formation is placed where volcanic rock is volumetrically minor. Felsic rocks are massive and pale green consisting of ignimbrite, tuff, flows and basaltic andesite flows.

Finely laminated mudstones occur only in the Moose River Member. The mudstone consists of fine-grained subangular to subrounded quartz, albite and minor pyrite in a matrix dominated by sericite, chlorite and minor biotite, which define a weak cleavage, generally at a small angle to bedding. Coarser units display graded bedding.

The Moose River Member was probably deposited in a submarine environment because the mudstones are inferred to have been deposited by turbidity currents.

RESULTS OF THE 1988 FIELD CHECK (Northcote and Armitage)

Geologic Description:

This was a cursory examination made of a pyritic zone reported by Murphy (1986). Minor iron-staining is in foliated siltstone metagreywacke.

Chip samples representative of the iron-stained exposure were taken for chemical analyses.

TABLE 1

GREENVALE PYRITIC ZONE SAMPLE

88-GV(PY)-1101	Foliated, sheared, chert pebble conglomerate(?) is very intensely crackled masking the original texture. Sericite-rich matrix produces foliation. Orange clay-like material in cavities. Disseminated euhedral crystals of pyrite. Iron-staining in fractures.

The sample was run by Direct Irradiation/INAA for Au plus 33 additional elements and by Atomic Absorption for Cu, Zn, Ag, and Pb, and by Fire Assay/Atomic Absorption for Au.

This single set of analyses indicated nothing of economic significance but gave an anomalous value of 1700 ppm for Zr.

T27

TABLE 2
GREENVALE PYRITE #4 ANALYSES

GREENVALE (pyrite)	Au + 33																		
88-GU	NAX	Sc	Cr	FeX	Co	Ni	Zn	As	Se	Br	Rb	Zr	Mo	Ag	Cd	Sn	Sb	Te	
1101	0.2	0.5	200	5.6	<5	<20	120	2.9	6	<2	130	1700	5	<2	<5	<100	1.1	<10	

GREENVALE (pyrite) ATOMIC ABSORPTION						
88-GU	Cu	Zn	Ag	Pb	Au ppb	
1101	2	111	<0.1	4	<5	

[redacted] [redacted] [redacted] [redacted] [redacted]

Sb	Ta	Ce	Ba	La	Ce	Sm	Eu	Tb	Yb	Lu	Hf	Ta	W	Ir	Au	Th	U	HT
1.1	<10	5.2	288	42	148	14	<1	5	14	2.1	33	9.1	<1	<58	ppb <2	19	4.9	34.24

GREENVALE PYRITE
NTS 11E/09B
Figure 1

McGRATHS MOUNTAIN

OCCURRENCE: McGRATHS MOUNTAIN (Hematite)

LOCATION: 5042800 N 550100 E NTS 11E/09B

ACCESS:

At McGraths Mountain, approximately 100 m southeast of the crossroad to Woodfield, a rubbly subcrop area of iron-stained granite occurs along the sides of the road with a small outcrop exposed in the roadbed.

REFERENCES:

Murphy, J. B., 1986. Geological map of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

GEOLOGY: (Murphy, 1986).

Iron-staining is in Devono-carboniferous (DG) granite.

RESULTS OF 1988 FIELD CHECK (Northcote and Armitage)

A sample was taken from a pyritic zone indicated by Murphy (1986) at McGraths Mountain.

TABLE 1

McGRATHS MOUNTAIN SAMPLE

88-McG-1301	Iron-stained leucocratic granite(?). Quartz and iron-stained feldspar. Interstitial clusters of hematite grains, fracture-fillings and along incipient fractures. Nonmagnetic.

Sample was analyzed by Direct Irradiation/INAA, Atomic Absorption methods and Fire Assay/Atomic Absorption, (for Au), for a total of 36 elements with some duplication of analyses by different methods.

The analyses showed nothing of economic significance. Zr gave an anomalous value of 2600 ppm.

MCGRATHS MOUNTAIN IRON
NTS 11E/09B
Figure 1

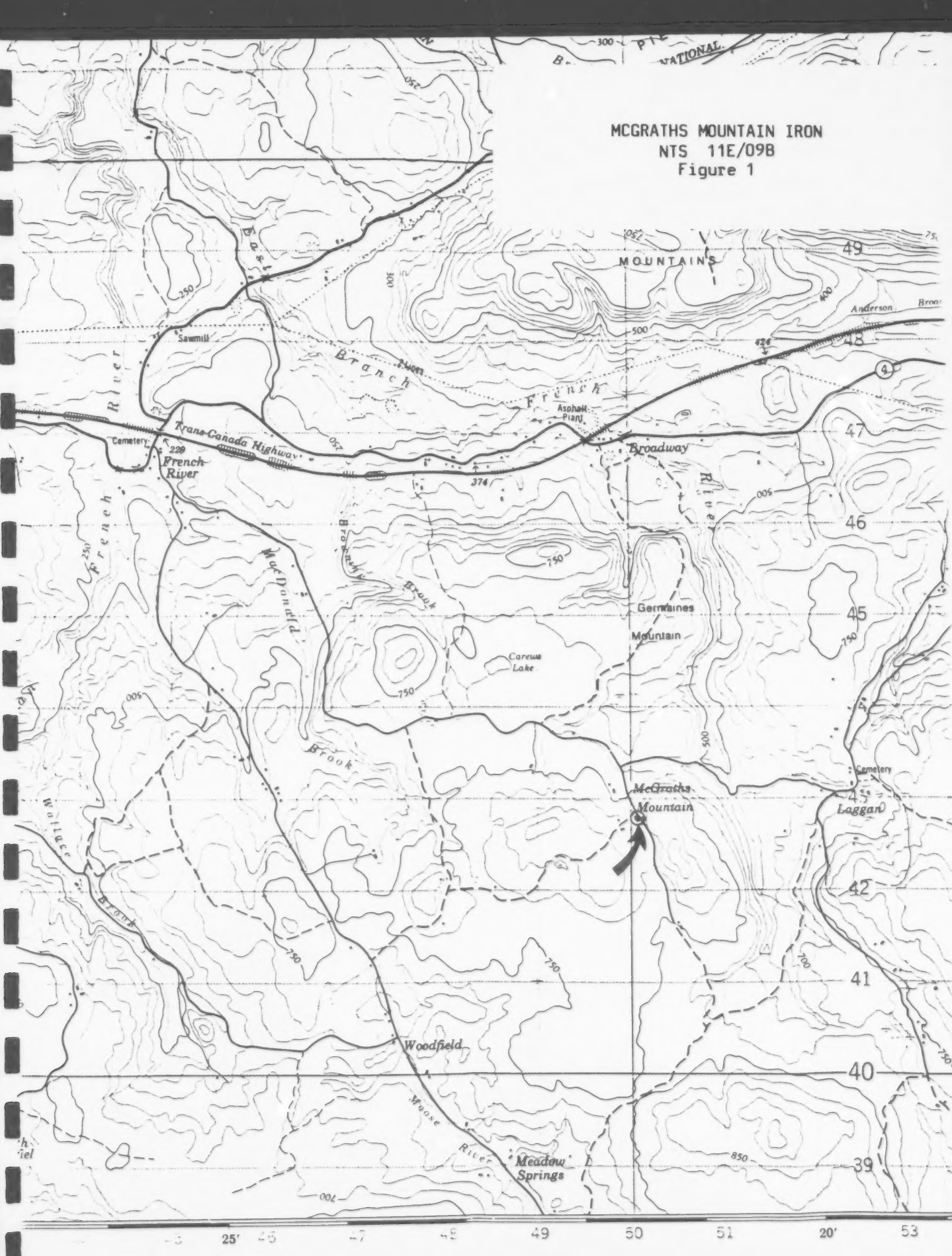


TABLE I

Mc GRATH PYRITE 65 ANALYSES

| | | |

ARISAIG POINT

OCCURRENCE: ARISAIG E16-06 (Anomalous Pb, (Au, Cu))

LOCATION

(a) Cannery Point 5067780 N 564400 E NTS 11E/16A
(b) Cannery Road 5067670 N 564760 E
(c) MacGillivray Bk 5068460 N 565830 E

ACCESS:

From Arisaig drive to Arisaig Point. The first occurrence is on the point beside the fish processing plant. The second occurrence is on the north side of Arisaig Point road 200 m east of the fish processing plant. The third occurrence is 1.6 km east of Airisaig Point in a little bay beyond a prominent felsite knob. Excellent exposures occur almost continuously along the beach.

REFERENCES:

Boucot, A. J., Dewey, J. F., Dinely, D. L., Fletcher, R., Fyson, W. K., Griffin, J. C., Hikox, C. F., McKerrow, W. S. and Ziegler, A. M., 1974. Geology of the Arisaig area, Antigonish County, Nova Scotia. Geological Society of America, Special Paper 139, 191 pp.

Fletcher, H., 1886. Report on geological surveys and exploration in the counties of Guysborough, Antigonish and Pictou. GSC Annual Report for 1885, 2, p. 5-28A.

Keppie, J. D., Dostal, J., Zentilli, M., 1978. Petrology of the Early Silurian Dunn Point and McGillivray Brook Formation, Arisaig, Nova Scotia. NSDME Paper 78-5, 20 pp.

GEOLOGIC ENVIRONMENT:

Keppie et al. (1978) present data which indicate an extensional, within-plate, continental rift environment for the Early Silurian volcanic rocks at Arisaig.

AGE:

Best estimate of age of the Dunn Point and McGillivray Brook Formations is 434 ± 15 Ma (Rb/Sr) in Fullager and Bottino (1968a) and Bofinger (1970) as cited by Keppie et al. (1978).

GEOLOGY OF ARISAIG POINT TO DUNN POINT:

The rocks along the beach are referred to as the Dunn Point and McGillivray Brook Formations (Boucot et al., 1974). The Dunn Point Formation (>220 m thick) conformably underlies the McGillivray Brook Formation (0-130 m thick) (Keppie et al., 1978). For petrographic descriptions see Keppie et al. (1978) and Boucot et al. (1974).

The rocks are bimodal mafic and felsic volcanic and the most likely origin of the felsic rocks is by partial melting of the crust in contact with the rising basaltic magma (Keppie, et al., 1978).

ALTERATION:

Keppie et al. (1978, p. 9) discuss effects of alteration recognized in thin section, reflected by lithochemistry. The alteration is referred to as secondary alteration but no clear distinction is made between regional and hydrothermal alteration and possible economic implications.

PREVIOUS WORK:

Fletcher (1886) reports two mineral occurrences at Arisaig. The first (a) is at the tip of Arisaig Point and the second (b) is behind and to the west of Arisaig chapel.

(a) Copper mineralization in quartz veins in rhyolite at the tip of Arisaig Point.

(b) Copper mineralization in veins (not located). Note the chapel (1886) may have pre-dated, and have been at a different location, than the present catholic church.

A small agalmatolite quarry operation was carried out on the outcrop at the east side of Arisaig Point road, 200 m east of the fish processing plant.

RESULTS OF THE 1988 FIELD CHECK (Northcote and Armitage)

At Keppie's suggestion, regarding possible mineral potential of the Silurian felsic volcanics in the Antigonish Highlands, the mineral occurrences reported by Fletcher, 1886 were field checked.

The vein systems at the point beside the fish processing plant and at the agalmatolite quarry on the east side of Arisaig Point road, (particularly on the point) showed swarms of discontinuous, branching, anastomosing quartz-barite veins and veinlets with fairly consistent attitudes of approximately 10-20°/55-70° NW. Vein thicknesses range from composite 15 cm to simple hairline fracture fillings with open space drusy zones lined by quartz, (locally chalcedony) sericite and barite crystals. Small clusters of chalcopyrite and pyrite mineralization occur in the vein systems at the point.

A traverse east along the beach almost to McGillivray Brook showed the bimodal nature of the mafic and felsic volcanic rocks. The volcanic rocks have irregular interbedded hematitic zones which may be tuffaceous sedimentary or may represent the lateritic zones referred to by Keppie et al. (1978, p. 3 and 4). Stratigraphic relationships are obscured by strong shear deformation which is locally extremely intense (Keppie et al., 1978, Fig. 2, 2a, 2b).

What is readily apparent, however, is that although some widely spaced quartz veining associated with epidote occurs in the mafic volcanic rocks, zones of hydrothermal quartz veining and broader elongate zones of hydrothermal albite, sericite and quartz alteration are prevalent in the felsic volcanic rocks. There are several of these pale yellow green hydrothermal alteration zones along the section examined. They are 4 or 5 m wide and >60 m long, trending 080°/near vertical, parallel to the bedding/structure of the rocks. These alteration zones have an albite-sericite-quartz-rich core with irregular protrusions of alteration impregnating the K-spar-rich, hematitic, felsic wallrocks with quartz gash veins cutting across both. A mottled hematitic coloration and bleaching accompanies the protrusions of alteration into the wall rocks. Samples from these zones show elevated zirconium values. A pyritic brecciated zone (88 AR 814) occurs on the southeast side of the most easterly of the hydrothermal alteration zones examined, and gave a lead value of 1895 ppm.

Results of Analyses:

A total of 15 samples with replicates were collected from Arisaig Point, the quarry, and eastward along the beach almost to McGillivray Brook. They were used for petrographic and geochemical analyses and were sent to Bondar Clegg Laboratory, Ottawa, for a combination of Direct Irradiation/INAA and Atomic Absorption analyses for 36 elements. Table 1 summarizes the petrography of the samples and Table 2 lists the analytical results.

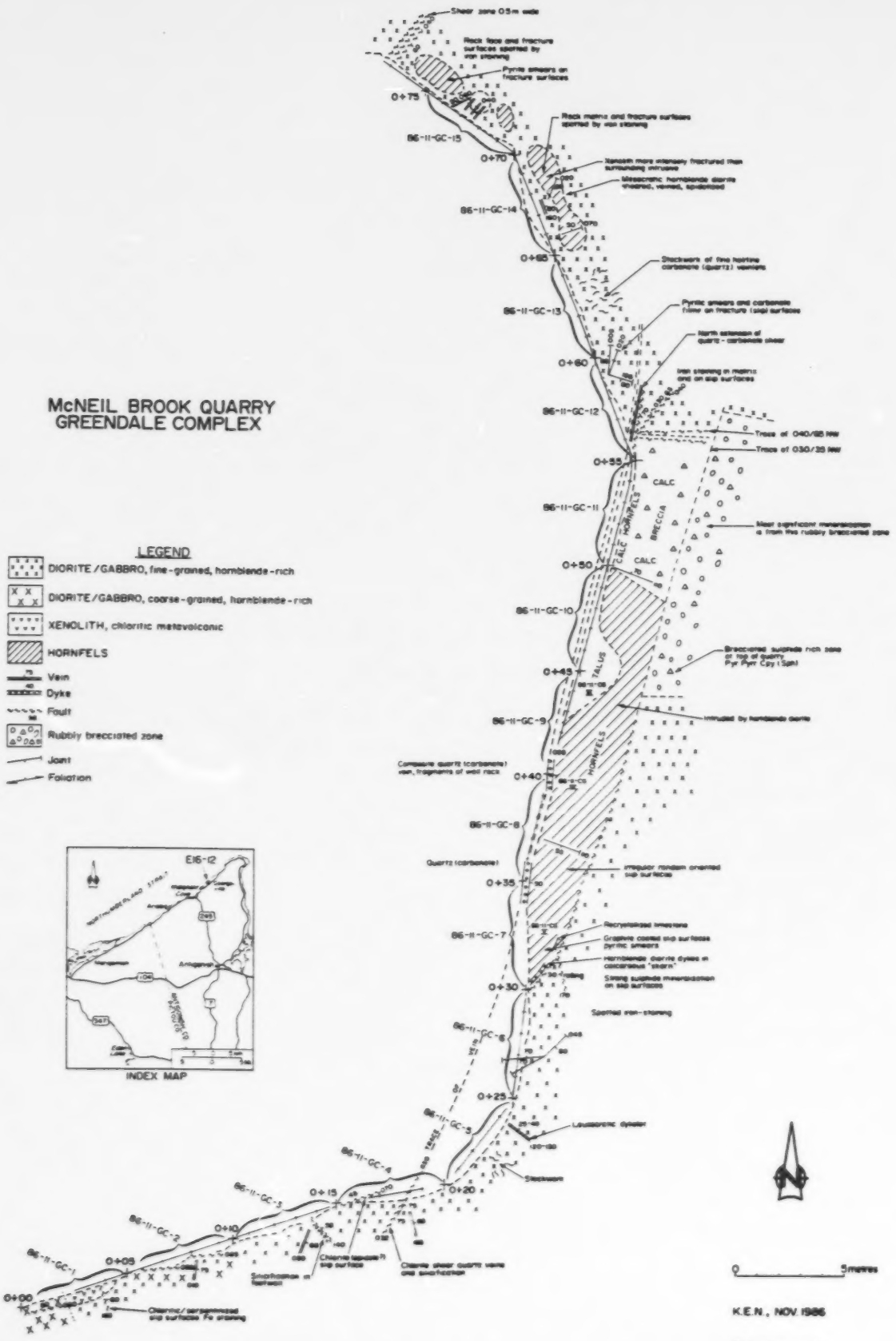

McNEIL BROOK QUARRY
GREENDALE COMPLEX
LEGEND
DIORITE /GABBRO, fine-grained, hornblende-rich
DIORITE/GABBRO, coarse-grained, hornblende-rich
XENOLITH, chloritic metavolcanic
HORNFELS
Vein
Dyke
Fault
Rubbly brecciated zone
Joint
Foliation
INDEX MAP
E16-12
Shear zone 05m wide
Rock face and fracture surfaces stained by iron staining
Pyrite smears on fracture surfaces
Rock matrix and fracture surfaces stained by iron staining
Mesocratic hornblende diorite sheared, veined, epidotized
Stockwork of fine hairline carbonate (quartz) veinlets
Pyritic smears and carbonate flow on fracture (slip) surfaces
Trace of 040/85 NW
Trace of 030/35 NW
CALC HORNFELS BRECCIA
CALC
TALUS
Minor supergene mineralization & iron fine rubbly brecciated zone
Brecciated sulphide rich zone at top of quarry Py Pyrr Cpy (Sph)
Intruded by hornblende dyke
HORNFELS
Coarse quartz (carbonate) vein, fragments of wall rock
Quartz (carbonate)
Irregular random oriented slip surfaces
Recrystallized limestone
Graphite coated slip surfaces pyritic smears
Hornblende diorite dykes in calcareous "skarn"
Strong sulphide mineralization on slip surfaces
Spotted iron-staining
Lamprophyric dyke
Stockwork
Chlorite (epidote?) slip surfaces
Chlorite shear quartz veins and stockwork
Chlorite/serpentinized slip surfaces Fe staining
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
0+55
0+60
0+65
0+70
0+75
86-11-GC-1
86-11-GC-2
86-11-GC-3
86-11-GC-4
86-11-GC-5
86-11-GC-6
86-11-GC-7
86-11-GC-8
86-11-GC-9
86-11-GC-10
86-11-GC-11
86-11-GC-12
86-11-GC-13
86-11-GC-14
86-11-GC-15
0 5 metres
K.E.N., NOV. 1986

Figure 2

The following samples from Arisaig point-beach gave analytical values of metallogenic significance.

88 AR 801	barium	31 000 ppm
88 AR 803	copper	253 ppm
	lead	56 ppm (weak)
	gold	110 ppb (150 ppb)
	barium	90 000 ppm
88 AR 804	gold	38 ppb (53 ppb)
	barium	47 400 ppm
88 AR 805	barium	90 000 ppm
	zinc	132 ppm (weak)
88 AR 811	zinc	167 ppm (weak)
	lead	99 ppm (weak)
88 AR 812	zinc	276 ppm (weak)
	lead	139 ppm (weak)
88 AR 814	zinc	248 ppm (weak)
	lead	1 895 ppm

However, no major vein systems or sulphide mineralization, other than minor limonitic staining, is associated with these hydrothermal alteration zones.

GENESIS:

The veins and most intense alteration zones are of hydrothermal origin associated with the felsic volcanic rocks. Sulphide mineralization associated with them is very sparse. The felsic component, whether a result of differentiation of basaltic magma or partial melting of crustal material by rising basaltic magma (Keppie et al., 1978), appears to have had low initial metal and/or sulphur content. If this is true then it does not bode well for the mineral potential of the Dunn Point and MacGillivray Brook Formation.

TABLE 1

ARISAIG SAMPLE DESCRIPTIONS

88 AR 801A Laminated devitrified rhyolitic(?) volcanic glass. Almost entirely fibrous radiating texture of devitrified glass. Dusting of hematite of varied intensity along laminae. Some lensoids of quartz and muscovite (sericite) between laminae. Stained slab shows strong potassium stain.

88 AR 801B Predominantly quartz and barite. Brecciated, crackled, contains fine granular sericitic fragments, some contain fracture fillings of sericite. Noncalcareous.

88 AR 801C Open space quartz-sericite (muscovite) and white bladed barite forming open space vugs, mottled by orange-red iron staining. Contains segregations or lensoids of sericite-like waxy textured mineral (sericite?, pyrophyllite?, agalmatolite?). Wall-rock is tuffaceous. Iron-stained, dusted, feathery radiating layer? Whispy sericitic partings.

88 AR 802 Laminated, hematitic, potassium-rich devitrified glass. Quartz lensoids, coarser bladed sericite (muscovite) lensoids between laminae. Crackled, sericitic network.

88 AR 803 Quartz vein (in felsite as for 802), fractured, brecciated, abundant small ghost-like fragments of felsite. Pale green sericitic patches. Late

fractures, open space quartz crystals. Noncalcareous. Other than iron-stain there is no evidence of mineralization.

88 AR 804, A, B Quartz and lesser barite vein, brecciated, composite, layers of quartz, some open space drusyness lined with quartz and barite crystals. Scattered lithic and quartz fragments. Crackled, late quartz and sericite infilling. Widely scattered clusters of chalcopyrite grains.

88 AR 805A Composite vein, quartz and barite, chlorite partings producing a composite nature. Barite occurs in pods and in open space cavities with quartz, generally associated with iron staining. Widely scattered clusters of chalcopyrite grains.

88 AR 806 Alteration zone, mottled pale creamy yellow-green, scattered darker green and cream-buff fragments. Irregular, masses of very fine sericitized feldspathic tuff in an irregular diffuse mosaic of coarser granular, interlocking irregular grains of quartz, feldspar (albite?) and sericite. Noncalcareous and there is no K-spar present.

88 AR 807 Alteration zone, mottled bright medium yellow green and pale cream yellow green, very fine-grained, massive. Scattered yellow green spots of sericite-like material. The groundmass is composed of irregular interlocking sericitic feldspathic grains (albite?), with some areas intensely sericitic. Scattered clusters of irregular quartz grains. There is no twinning visible in the feldspars and the stained slab indicates that there is no K-feldspar present. Cut by veinlets of quartz and lesser sericite.

88 AR 808 Partly altered K-spar-rich felsite, reddish brick colour mottled by pale orange-pink with siliceous impregnations and discontinuous veinlets. Stained slab shows stained remnants of K-spar rich tuffaceous felsite remnants impregnated by a coarser mosaic of albitic(?) feldspar, lesser quartz and sericite.

88 AR 809 Felsite, mottled pale brick red and pinkish orange. Crackle breccia. Tuffaceous lithic fragments, K-spar and quartz. Veins:
(a) sericite network
(b) carbonate
(c) quartz and dark green chlorite-related mineral
(d) probable albite, untwinned and as a diffuse impregnation.

88 AR 810A Felsite crackle breccia, brick red hematitic tuffaceous felsite impregnated by long laths/acicular crystals, felted, low relief and birefringent albite(?) forming snowflake cluster textures. Veinlets of quartz, sericite and albite(?).

88 AR 811 Sericitic felsite cut by irregular, diffuse quartz. Fine granular feldspathic tuff, feldspathic groundmass ranges from very fine granular tuffaceous to a medium grained mosaic of interlocking feldspathic grains. Varied intensity of sericitization. No polysynthetic twinning of feldspars. No evidence of K-spar in stained slab.
Veining: coarse quartz, coarser acicular/bladed sericite at the margins. Late albite(?), untwinned, biaxial (-). Sericitic networks cut through the sericitic groundmass. Quartz shows some dusting of hematite with lower intensity in later generations of quartz.

88 AR 812 Quartz vein, composite, several generations of quartz, open space vugs. Scattered diffuse zones of sericite.

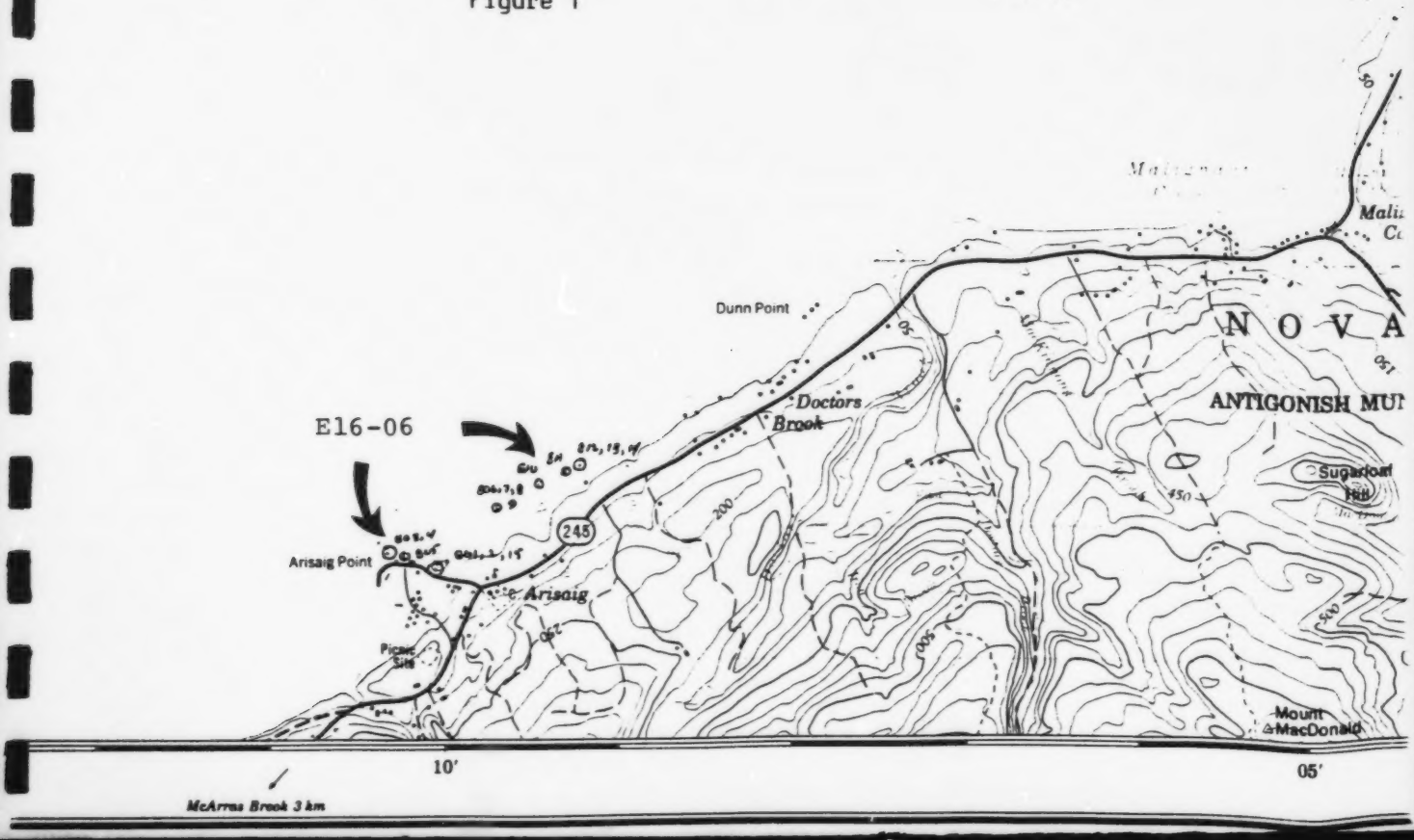
88 AR 813 Sericitic alteration, felsite, layered, very fine grained aspect. Stained slab shows two small spots of K-spar. Very fine sericitized feldspathic (albite?) and lesser quartz forms a tuffaceous groundmass, sericitic material forms fine "crenulated" preferred orientation. Scattered feldspathic (K-spar) lensoids and lensoids of sericitic feldspar and quartz. No twinning was observed in the feldspar.
Note: This sample has a fine tuffaceous texture throughout and lacks the coarse mosaic associated with the specimens that are believed to be albitized. This suggests that some of the beds may originally have been K-spar deficient.

88 AR 814 Brecciated felsite tuff, pale purplish colour, aphanitic. Breccia matrix dark/medium green soapy mineral, (agalmatolite, sericite, pyrophylite). Pyrite. Stained slab indicates that the breccia fragments are predominantly K-spar. K-spar, dusted with hematite, irregular shape, warped. Quartz, 25%, elongate warped grains, diffuse margins. Fracture fillings:
(a) pyrite, euhedral crystals associated with sphene(?)
(b) sericite, abundant feldspathic inclusions
(c) sericite, extremely fine granular
(d) quartz
(e) barite, fine prismatic, dusted like K-spar (iron-stained).

88 AR 816 A, B Hematitic laminated felsite, rhyolitic(?). Alternating very fine tuffaceous layers with slightly coarser pelletoid layers, siliceous. Discontinuous siliceous partings along foliation planes. Stained slab shows K-spar rich layers. Vugs filled with agalmatolite(?).

Veins: quartz, 2 generations, possible albite(?). Trace epidote crystals. Sericite/pyrophyllite(?).

ARISAIG POINT E16-06
NTS 11E/16A
Figure 1



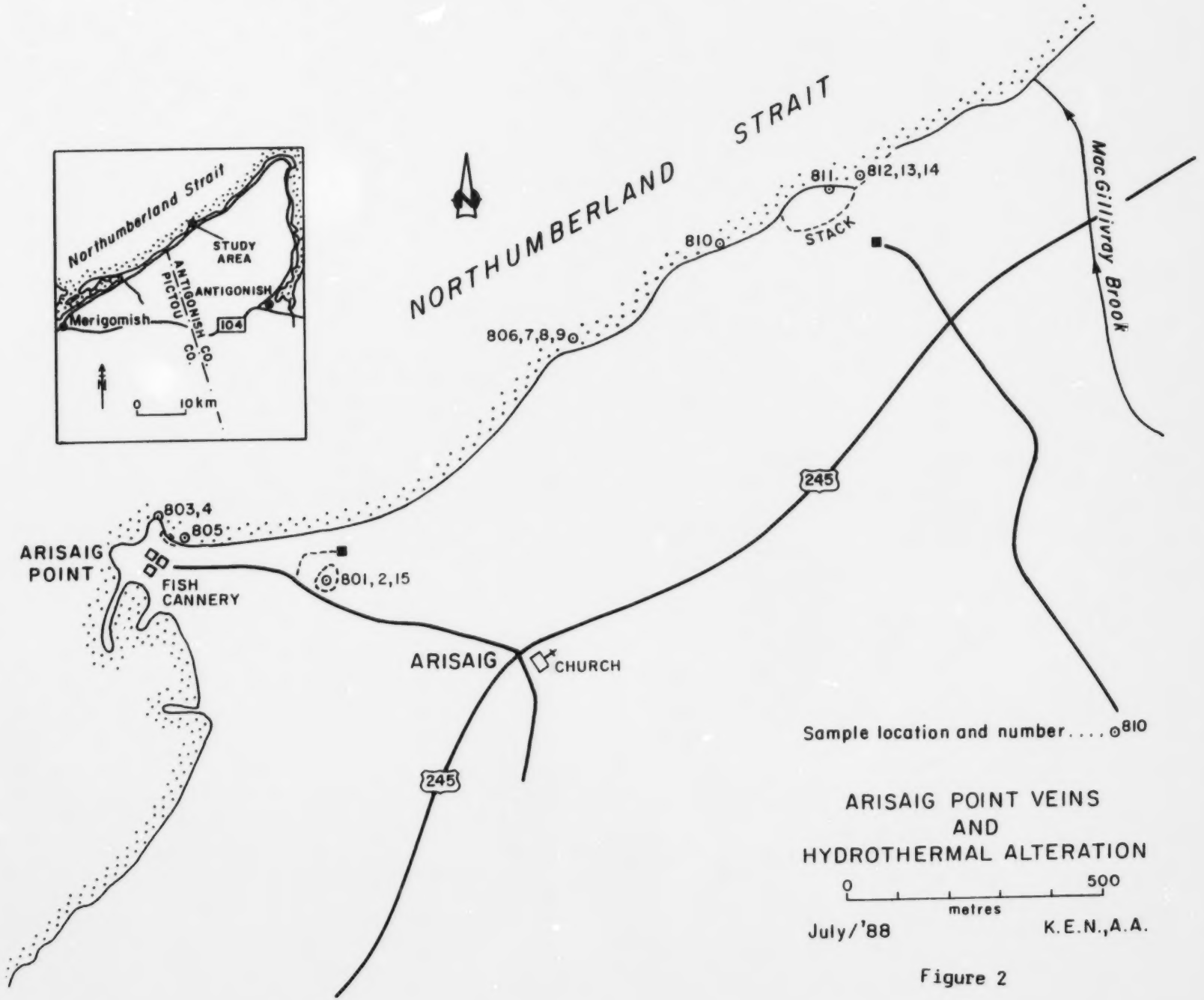

Northumberland Strait
STUDY AREA
ANTIGONISH
PICTOU
ANTIGONISH CO.
Merigomish
104
0 10km
NORTHUMBERLAND STRAIT
811
812,13,14
STACK
810
806,7,8,9
Mac Gillivray Brook
245
803,4
805
ARISAIG POINT
FISH CANNERY
801,2,15
ARISAIG
CHURCH
245
Sample location and number.... 810
ARISAIG POINT VEINS
AND
HYDROTHERMAL ALTERATION
0 500
metres
July/'88
K.E.N.,A.A.

Figure 2

T29

TABLE 2
ANALYSES

ATOMIC ABSORPTION

CHISHOLM BROOK

OCCURRENCE: CHISHOLM BROOK E16-11 (Pyrite)

LOCATION: 5072320 N 572150 E NTS 11E/16A

ACCESS:

Drive east 2.15 km along highway 337 from the junction of highways 245 and 337 at Malignant Cove. Turn left and follow the private road 0.6 km to the beach. Discontinuous pyritic lensoids occur in outcrops along the shoreline from a point just east of the mouth of Chisholm Brook for about 1 km easterly.

REFERENCES:

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

Murphy, J. B., 1986. Geology of the central and southern Antigonish Highlands. GSC Open File 1181, sheets 1 and 2, scale 1:50 000.

TECTONIC SETTING:

The Chisholm Brook Formation of Late Precambrian age is composed of a succession of basaltic andesite lava flows and pyroclastic volcanics which exhibit transitional chemistry between early tholeiitic and later calc-alkaline volcanic suites. These volcanic rocks are interbedded with lesser limestone and mudstone and are consistent with early incipient stages of rifting during development of a shallow ocean floor intra-arc basin (Murphy et al., in press).

The Chisholm Brook Formation is post-tectonically intruded by the Greendale Complex which produced hornblende $^{40}Ar/^{39}Ar$ discordant release spectrum ranging from 650 - 600 Ma (Reynolds,1980); Alaskite granite K/Ar on muscovite 604 $\pm$ 14 Ma (Wanless, 1975) and Rb/Sr whole rock isochron 535 $\pm$ 13 Ma (Cormier, 1981) all quoted by Murphy et al. (in press).

The Chisholm Brook Formation forms part of the Georgeville Block bounded on the north and south by the Hollow and Greendale faults, respectively (Murphy et al., in press).

GEOLOGICAL DESCRIPTION: (Northcote)

The Chisholm Brook section consists of green basaltic - andesite lavas and pyroclastic rocks interbedded with lesser white - grey banded marble, argillaceous limestone and grey mudstone. Individual flows and beds are up to 4 m thick (Fig. 1). At Chisholm Brook these rocks are intruded by the Greendale Complex.

Results of petrographic examination of 56 thin sections are in agreement with petrographic descriptions of Murphy et al. (in press). However, macro and micro zones of strong, late, cataclasis, which are impressed on the volcanic and sedimentary rock fabric should be noted. This late crushing and open brecciation with associated iron staining obscures primary rock structures and textures in outcrop and textures in thin section.

Volcanic Rocks:

Primary volcanic textures of the volcanic rocks, such as felted flow or fragmental groundmass and breccia nature are only partially preserved. Cataclasis obscures much of the primary fabric. In addition, thin sections show the volcanic mineralogy is secondary, further obscuring primary textures. The secondary mineralogy is dominated by albite, actinolite, epidote, chlorite, carbonate, quartz and sphene which is representative of greenschist facies regional metamorphic

grade. Emplacement of Greendale Complex has superimposed a contact metamorphic assemblage of garnet and hornblende on the above (Murphy et al., in press).

Sedimentary Rocks:
Limestone and argillaceous limestone have fine sugary recrystallized textures and, in proximity to the Greendale Complex, form medium crystalline marble. These rocks are predominantly calcite with tremolite, chlorite, epidote, quartz and serpentine after olivine (Murphy et al., in press; Fig. 1). Zones of crushed or cataclastic textures are common.

Minor interbedded shale has similar secondary mineralogy to the volcanic assemblage but retains a fine granular sedimentary fabric.

Veining by quartz, carbonate, epidote and chlorite with lesser anhydrite (?), prehnite (?) and gypsum occurs in all lithologies.

Greendale Complex:
The Greendale Complex at this occurrence consists of very coarse-grained plagioclase, amphibole and pyroxene. The plagioclase is altered to varied degrees by sericite, epidote and carbonate. Amphibole (hornblende) forms large altered anhedral crystals up to several cm. Pyroxene forms subhedral crystals or grain remnants associated with amphibole and both of these mafics show varied amounts of chlorite alteration. Cataclastic textures are superimposed on the rock fabric.

STRUCTURE:

The Georgeville Block is bounded on the north and south by the Hollow and Greendale faults respectively and is polydeformed by several generations of folding. Closure of the basin in the latest Precambrian resulted in polyphase deformation and was initially associated with westward-directed thrusting, folding and dextral movement on the Hollow Fault (Murphy et al., in press).

MINERAL POTENTIAL:

The tectonic environment suggests possible Cyprus type (Cu, Pb, Zn, Cr, Ni, Pt) volcano-sedimentary deposits might occur. In addition, the post-tectonic emplacement of the Greendale Complex could result in contact metamorphic/metasomatic mineralization. Remobilization and precipitation of metals could have occurred during deformation or as a result of intrusion with metals derived from the pluton or from the volcanic-sedimentary basin.

Mineralization: (Northcote)
Pyrite is weakly (<5%) disseminated throughout the rock matrix and fills hairline fractures in the volcanic - sedimentary sequence. Lensoids, up to 5 m (in largest dimension), of richer (5-10%) sulphide mineralization are scattered in the volcanic rock along the outcrop area. Reflected light petrographic examination shows pyrite disseminated throughout the rock matrix but richer sulphide mineralization occurs as fracture fillings. Pyrite predominates with lesser marcasite and blebs of chalcopyrite, pyrrhotite and sphalerite(?). Traces of an unidentified pale isotropic mineral also occur in pyrite. Pyrite shows varied amounts of oxidation to hematite in fractures and around the edges of grains and in veinlets. Presence of sphalerite is suspected but masked by the abundance of hematite. Coarse pyrite grains are associated with quartz veinlets.

ANALYSES: (Northcote)

Samples were analyzed at Bondar Clegg, Ottawa, for a total of over 46 elements and 10 oxides by a combination of Direct Irradiation/INAA, Atomic Absorption, X-ray Fluorescence, D. C. Plasma and conventional assay.

Results of analyses and a description of samples are given on Tables 1 and 2. The purpose of the analyses was to determine which elements might be of economic interest and to provide a basis of comparison for major and trace element analyses of mineralized with unmineralized Chisholm Brook.

Analyses of mineralized and unmineralized samples of Chisholm Brook and Greendale Complex show slightly to weakly anomalous Cu and Zn values but nothing of economic significance. As a precaution, in this tectonic environment, the best mineralized samples were also analyzed for platinum group metals which produced no significant values.

SIGNIFICANCE:

The occurrence is of metallogenic significance for pyrite. The lack of apparent economic significance at this location should not rule out investigation of other occurrences in similar geologic environments.

TABLE 1

DESCRIPTION OF SAMPLES THAT WERE ANALYZED

86-11-CB-1 Basaltic andesite flow, dark green-grey, massive seriate, weak flow foliation, epidote spots, carbonate and quartz alteration. Crackle brecciation. Veinlets, chlorite, carbonate and quartz.

86-11-CB-5 Porphyritic basaltic andesite, flow breccia with high fragment to matrix ratio, felted plagioclase, amphibole, pyroxene. Chlorite, carbonate alteration. Pyrite mainly as fracture fillings and cataclastic zones, coarser euhedral crystals associated with quartz. Very minor disseminated pyrite in rock matrix.

86-11-CB-13 Basaltic andesite, flow? pyroclastic?, randomly oriented plagioclase laths, needles, altered mafic (amphibole) chloritic, aggregates of fine opaques.

86-11-CB-17 Basaltic andesite, flow, cataclasite, gradational grain-size, interlocking plagioclase, interstitial chlorite. Cataclastic texture.

86-11-CB-18 (a) Altered pluton, fine granular texture, optically continuous granular amphibole(?).
(b) Cataclasite, former basaltic andesite pyroclastic breccia, with flow fragments, strong overprint of carbonate, chlorite. Veining gypsum, carbonate, chlorite.

86-11-CB-19 Basaltic andesite, pyroclastic breccia, high fragment to matrix ratio, felted plagioclase and amphibole laths in fine granular chloritic matrix, epidote clots, scattered lithic fragments of metasediment. Superimposed secondary cataclasis, crackle brecciation. Veinlets, gypsum, iron staining. Pyrite and hematite veinlets, fracture fillings, trace chalcopyrite. Disseminations < 2% subhedral to anhedral pyrite grains in rock matrix.

86-11-CB-20 Basaltic andesite flow and flow breccia, bladed to felted plagioclase and amphibole laths/acicular crystals, interstitial chlorite. Veining and segregations of chlorite, quartz and gypsum. Pyrite filling veinlets and lesser disseminated grains throughout rock matrix. Chalcopyrite as small isolated anhedral grains. Hematite, abundant rimming pyrite and in fractures. Sphalerite(?) masked by hematite. Unidentified pale cream-white isotropic mineral as minute blebs in pyrite.

86-11-CB-23 Basaltic andesite, pyroclastic tuff breccia, scattered medium-grained feldspar laths in a fine, felted mass of plagioclase and amphibole. Crushed, incipient fractures. Pyrite, minor marcasite, hematite. Pyrrhotite blebs in pyrite. Chalcopyrite in very minor amounts as irregular grains associated with pyrite and hematite.

86-11-CB-24 Basaltic andesite, flow, feldspar and chlorite-felted texture. Fine granular dusty altered matrix (carbonate and chlorite). Weak sericitic alteration of plagioclase. Weak quartz impregnation, granular texture. Carbonate veins.

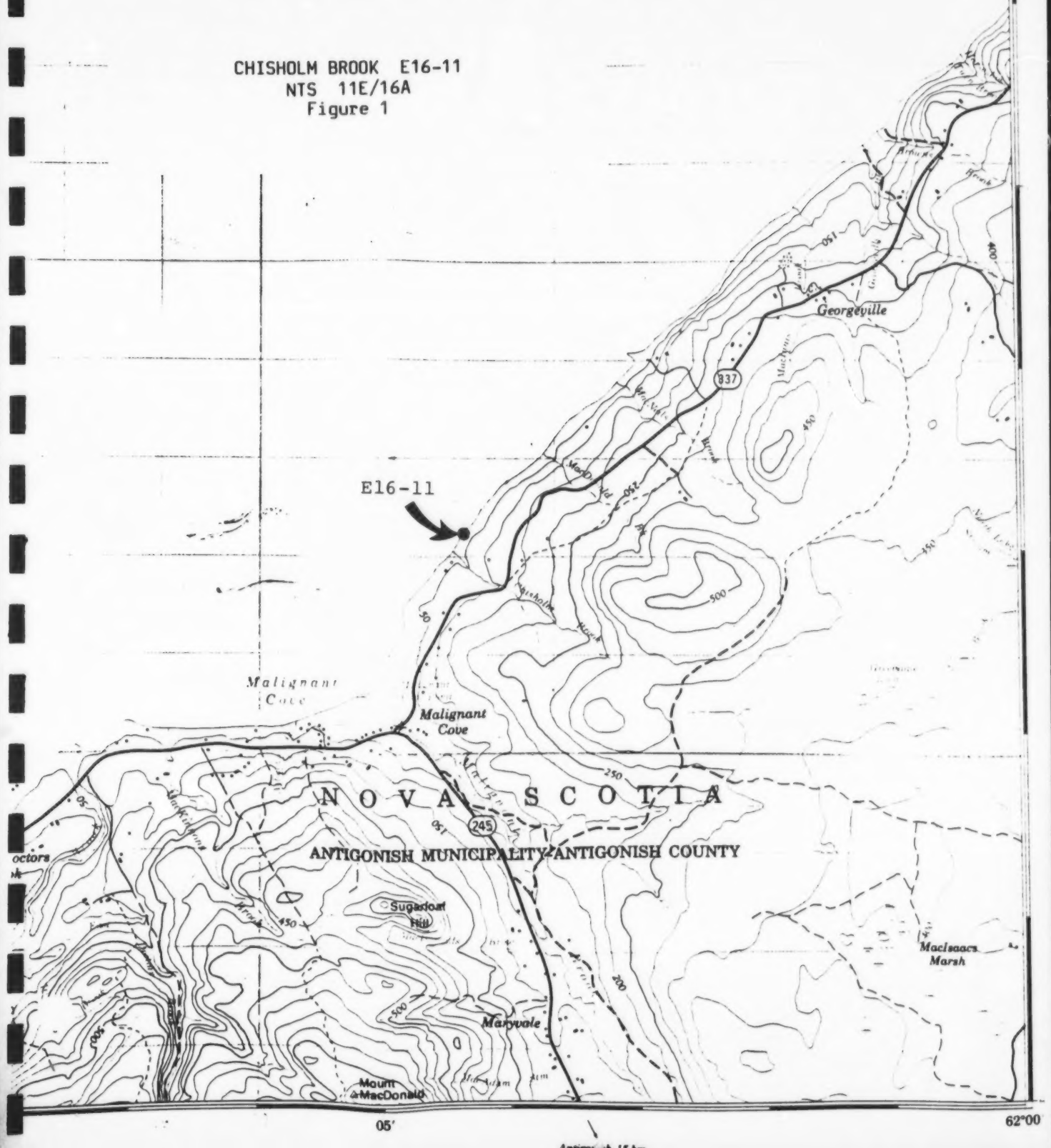
86-11-CB-26 Basaltic andesite flow, plagioclase and amphibole laths form a felted mass, chloritic in a very fine granular to dusty opaque aggregate groundmass, partly carbonate. Pyrite, marcasite veinlets with hematite and as disseminated grains throughout rock matrix. Chalcopyrite, very minor amounts with pyrite, marcasite, hematite in veinlets. Sphalerite(?) suspected, masked by abundance of hematite.

86-11-CB-27 Basaltic andesite, pyroclastic breccia, widely spaced ghost-like outlines of long pyroclastic laths in a fine felted feldspathic-amphibole groundmass, sedimentary lithic fragments, fragmental breccia nature. Chlorite alteration. Pyrite in veinlets with hematite and sparsely disseminated throughout rock matrix. Traces of chalcopyrite. Gypsum and quartz veinlets.

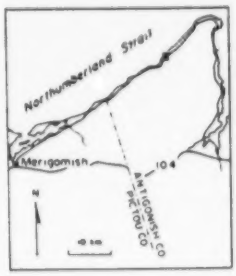
86-11-CB-IX Altered pluton, cataclasite, coarse plagioclase with intense sericite/carbonate alteration, amphibole, augite. Alteration, epidote, sericite, carbonate, chlorite. Veins/segregations of carbonate, chlorite, anhydrite(?) prehnite(?). Some sections predominantly coarse-grained poikilitic mafics.

86-11-CB-XII Altered pluton, coarse plagioclase, augite, hornblende. Strong sericitic alteration of feldspar. Veinlets/segregations of chlorite, carbonate, anhydrite/prehnite(?). Trace of pyrite, irregular grains.

CHISHOLM BROOK E16-11
NTS 11E/16A
Figure 1



CHISHOLM BROOK PYRITIC OCCURRENCE E 16-11



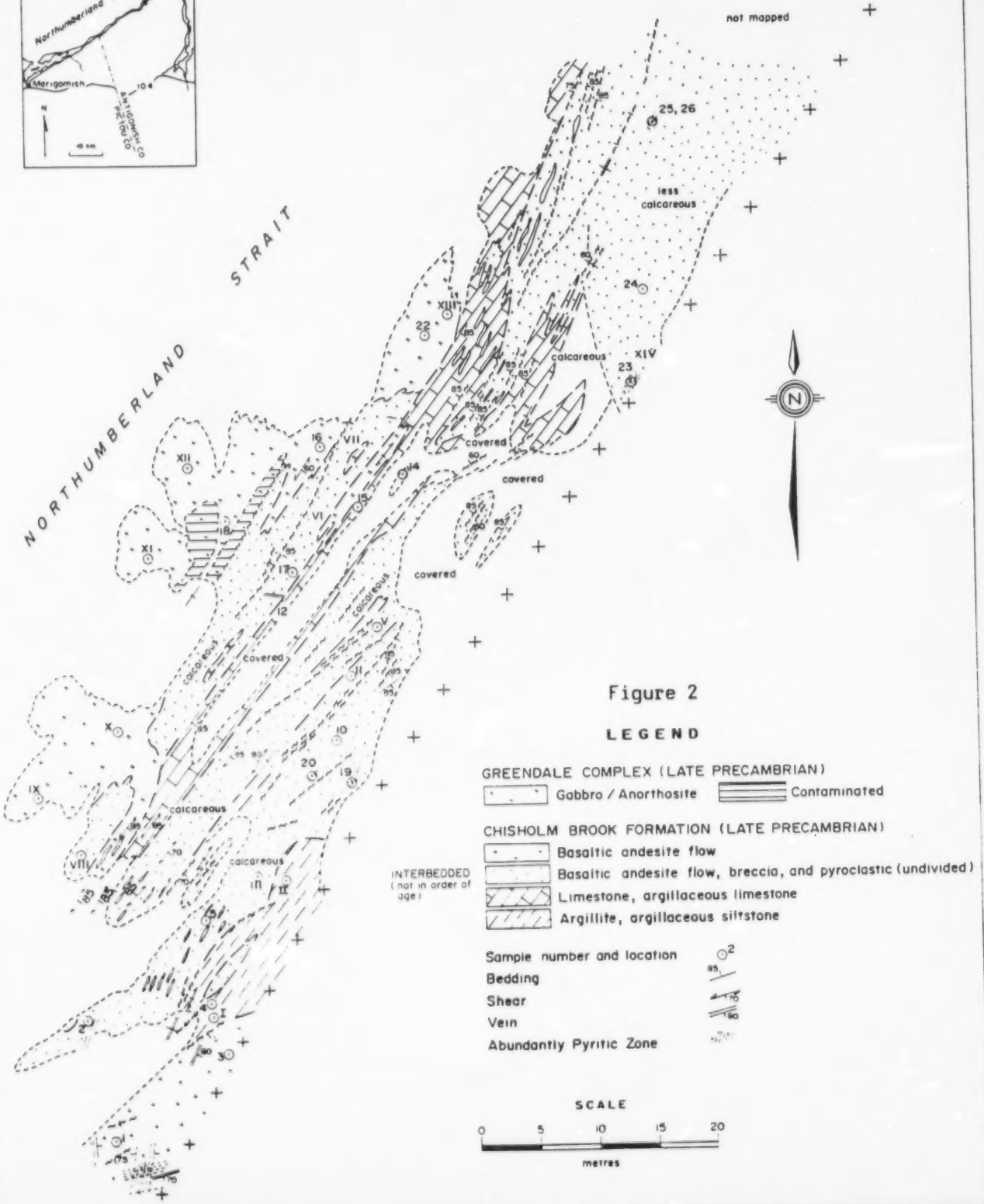


Figure 2

LEGEND

GREENDALE COMPLEX (LATE PRECAMBRIAN)

- Gabbro / Anorthosite
- Contaminated

CHISHOLM BROOK FORMATION (LATE PRECAMBRIAN)

- Basaltic andesite flow
- Basaltic andesite flow, breccia, and pyroclastic (undivided)
- Limestone, argillaceous limestone
- Argillite, argillaceous siltstone

Sample number and location ⊙2

Bedding 85

Shear 75

Vein 80

Abundantly Pyritic Zone

SCALE

0 5 10 15 20

metres

T30

TABLE 2
CHISHOLM BROOK ANALYSES

CHISHOLM 85-11-CB	BROOK	SILICATE ANALYSES SiO2	TiO2	Al2O3	Fe2O3*	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	Total
1		54.6	0.8	18.1	22.5	0.37	3.32	3.68	4.51	0.75	0.08	2.15	100.66
15		58.9	2.05	14.8	12	0.34	3.0	3.51	4.22	1.47	0.11	0.85	100.77
16		41.3	0.39	12	14.2	0.2	5.36	13.1	1.55	0.08	0.34	3.15	99.27
17		50.1	0.55	15	14.14	0.24	4.01	7.11	3.79	1.08	1.14	4.6	101.62
18		45	0.25	24.9	5.48	0.11	5.95	11.7	1.27	2.27	0.01	4.45	100.19
24		46.4	3.11	13.3	14.44	0.19	5.28	6.31	3.96	3.27	0.05	4.7	100.07
IX		45.4	0.76	7.94	9.17	0.11	14.7	15.3	2.03	0.46	0.09	4.7	101.69
XII		45.4	0.2	23.9	2.79	0.12	4.41	15.1	2.03	1.17	0.09	4.7	99.92

CHISHOLM 86-11-CB	BROOK	ADDITIONAL ANALYSES Li	Ba	Cu	Zn	Pb	Ni	Co	Mo	Ag	As	Sb	Bi	W	Sn	U	Th	Au ppb
1		66	<1	249	101	<0.2												
15		26	<1	64	359	<0.2												
16		66	<1	11	64	<0.2												
17		115	<1	21	106	<0.2												
18		44	<1	30	76	<0.2												
19		44	<1	52	214	<0.2												
20		55	<1	592	182	<0.2												
23		46	<1	346	114	<0.2												
24		115	<1	357	199	<0.2												
26		44	<1	440	114	<0.2												
27		150	<1	451	114	<0.2												
IX		23	<1	372	58	0.2	2	2	0	0	0	0	0	0	0	0	0	0
XII		23	<1	58	58	0.2	2	2	0	0	0	0	0	0	0	0	0	0

CHISHOLM 86-11-CB	BROOK	Au + 25 Cr	Sc	Fe%	Co	Ni	Cu	Zn	Ag	Cd	Sn	Sb	Te	Hg	Tl	Pb	Bi	Au ppb
1		37.4	21	0.6	14	16	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
15		41.7	12	1.4	11	10	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
17		31	21	2.4	11	20	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
18		27.7	20	1.4	11	16	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
19		49.5	11	0.6	11	10	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
20		55.6	30	1.4	16	20	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
23		46.9	11	0.6	10	10	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
24		46.9	11	0.6	10	10	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
26		44.5	11	0.6	10	10	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
27		74.5	11	0.6	10	10	<1	100	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	10
IX		28.5	1900	5.7	14	16	2	100	1.4	1.4	1.4	1.4	0.1	1.4	1.4	1.4	1.4	10
XII		25.2	170	1.8	14	16	2	100	1.4	1.4	1.4	1.4	0.1	1.4	1.4	1.4	1.4	10

CHISHOLM 86-11-CB	BROOK	PLATINUM GROUP ANALYES Ru	Rh	Pd	Os	Ir	Pt	Au ppb
19		<50	<1	<50	<50	<0.1	<50	9.6
26		<50	<1	<50	<50	<0.1	<50	9.6
27		<50	<1	<50	<50	<0.1	<50	9.6

MacNEILS BROOK QUARRY

OCCURRENCE: **MacNEILS BROOK QUARRY E16-12 (Zinc, (copper))**
Greendale Complex

LOCATION: **5074060 N** **574120 E** **NTS 11E/16A**
A rock quarry above the beach 0.5 km northeast of MacNeils Brook.

ACCESS:
From the junction of Highways 245 and 337 at Malignant Cove, drive northeastward on 337, crossing Chisholm and MacNeils brooks, for 5 km. Turn northwest (left) at gated access road and proceed for 0.8 km to the quarry (Fig. 1). The quarry operation has removed Greendale Complex rock containing xenoliths and pendants of sulphide mineralized metasediments and volcanics of the Chisholm Brook Formation (Fig. 2).

REFERENCES:
Murphy, J. B., Keppie, J. D. and Hynes, A. J., 1982. Geology map of the northern Antigonish Highlands. NSDME Map 82-5, scale 1:50 000.

Murphy, J. B., Keppie, J. D. and Hynes, A. J., In press. Geology of the Antigonish Highlands. GSC Memoir.

GEOLOGIC ENVIRONMENT: (Murphy et al., in press)
The quarry is in the Greendale Complex which contains xenoliths and pendants of Chisholm Brook Formation.

Greendale Complex: (from Murphy et al., in press)
The complex is composed of plutonic rocks ranging from gabbro to late stage felsic members showing wide textural variations with xenoliths and pendants of metasedimentary volcaniclastics, limestone and metavolcanic basalt.

The plutonic rocks contain predominantly amphibole relative to other mafic minerals. Although the igneous rocks have the appearance of hornblende diorite, geochemically they are gabbroic to intermediate. Fine grained lithologies predominate and consist almost totally of hornblende and plagioclase.

RESULTS OF 1986 FIELD CHECK: (Northcote)
The MacNeils Brook quarry was mapped at a scale of 1 to 100 and sampled for petrographic and chemical analyses. A summary of petrographic descriptions is given in Table 1. Samples were analyzed by a combination of Direct Irradiation/INAA, X-Ray Fluorescence, Atomic Absorption, conventional assay, and whole rock analyses for about 42 elements and 10 oxides.

Geology of MacNeils Brook Quarry:
A geological map was made of the upper (southeast) section of the quarry (Fig. 2). The quarry walls are predominantly fine-grained hornblende gabbro/diorite showing wide textural variation and relative amounts of rock forming minerals. The plutonic rocks contain xenoliths and small pendants of volcanic and sedimentary rock which show a range in degree of assimilation and contact metamorphism (metasomatism). Many of the contacts between plutonic rocks and pendants are now loci of fault planes (Fig. 2).

The sequence is cut by a number of quartz-carbonate veins, the most notable of which trends north-northeast, crossing the floor of the quarry at its east margin and extending up the north and south walls (Fig. 2).

Petrography:

Plutonic Rocks:

Examination of 36 thin and polished thin sections show that the plutonic rocks are composed mainly of plagioclase and hornblende with accessory quartz, apatite, sphene, zircon and rutile. Opaque minerals include magnetite and ilmenite. Xenoliths at various stages of assimilation have similar mineral assemblages. An assemblage of secondary minerals, superimposed on the above, includes plagioclase with albitic overgrowths and sericite, epidote and lesser carbonate alteration. Hornblende is altered to acicular amphibole (tremolite) and chlorite. One section contains serpentine pseudomorphs.

Metasediments/Volcanics:

The metasediments are metamorphosed to hornblende hornfels facies with a similar mineral assemblage to plutons but are generally finer grained. Limestone has been recrystallized to marble and is cut by discontinuous veinlets of carbonate and minor quartz with traces of wollastonite.

Veins:

Veins are composite multi- or unimineral types with gangue minerals composed of quartz, carbonate, chlorite, anhydrite, lesser gypsum and minor serpentine. Several zones of weakly to moderately sericitic plagioclase veining or impregnation were also evident.

Mineralization:

Most rock types are mineralized by sulphides as disseminations and as fracture coatings and filling crushed zones. The sulphides consist, in order of abundance, of pyrite/marcasite, pyrrhotite, sphalerite and chalcopyrite.

ANALYSES:

Polished thin sections have minor quantities of chalcopyrite and sphalerite which are also evident in assay data. Maximum gold values are in the order of 10 to 14 ppb. Mo values are moderately to strongly anomalous in a number of samples.

ANALYSES

Sample	Mo ppm	Zn ppm	Au ppb
GC-1			11
GC-6			10
GC-7	34	2900	
GC-8		810	
GC-9	104		
GC-9A	28	660	14
GC-11	13		
GC-I	17	3100	
GC-II	21	1600	
GC-III	41		
GC-IV	11		

Sphalerite and chalcopyrite do not occur in sufficient grade and quantity to be of economic value but are of metallogenic significance. No other elements appear to be in significant amounts.

TABLE 1
MacNEILS BROOK QUARRY, E16-12, ANALYSES

Sample 86-11-GC	Interval (Fig 2)	Lithology	Alteration	Mineralization	Type	Veins
1	0+00 0+05	Diorite/gabbro	Sericite, carbonate, chlorite, epidote	Pyrite, magnetite chalcopyrite, sphalerite	Disseminated and veinlets	--
1A	"	Andesite xenolith	--	(Opaques)	--	Calcite, anhydrite
2	0+05 0+10	Gabbro/diorite	Strong sericite tremolite	(Opaques)	--	Gypsum, anhydrite, carbonate, chlorite
2A	"	Vein	--	(Opaques)	--	Quartz, carbonate
3	0+10 0+15	Diorite inclusions	Sericite	(Opaques)	--	Carbonate, quartz, anhydrite
4	0+15 0+20	Gabbro	Sericite, amphibole, epidote	(Opaques)	--	Carbonate, anhydrite
4A	"	Diorite (cataclastic)	Chlorite	(Opaques)	--	--
5	0+20 0+25	Diorite	Sericite, amphibole, chlorite	(Opaques)	--	--
5A	"	Diorite	Chlorite, sericite	(Opaques)	--	Plagioclase, anhydrite, carbonate, quartz
6	0+25 0+30	Diorite	Sericite, chlorite	(Opaques)	--	Epidote, chlorite, anhydrite
7	0+30 0+35	Alteration (rutile)	Epidote, carbonate, quartz, chlorite, anhydrite	(Opaques)	--	Carbonate
7A	"	Amphibole hornfels	Epidote	Sphalerite, pyrite, (marcasite), magnetite	Disseminated and veinlets	Epidote, gypsum, carbonate, sulphide veinlets and filling crushed zones
8	0+35 0+40	Amphibole hornfels	Chlorite	(Opaques) strong	--	--
8A	"	Amphibole hornfels	Quartz, carbonate, epidote	Pyrite, pyrrhotite, chalcopyrite, hematite, (sphalerite)	Disseminated, veinlets, blebs	Sulphides
9	0+40 0+45	Hornblende diorite rutile	Sericite, epidote	<10% opaques, pyrite, pyrrhotite, chalcopyrite hematite, sphalerite	Disseminated and veinlets, blebs	Sulphides
9A	"	Skarn	Hornblende, amphibole, plagioclase, quartz, chlorite, carbonate, garnet, rutile	Pyrite, marcasite, pyrrhotite, chalcopyrite	Disseminated, veinlets, blebs	Sulphides
10	0+45 0+50	Xenolith/pendant	Chlorite	Pyrite, ilmenite, leucoxene, chalcopyrite	Disseminated, veinlets, blebs	Quartz, carbonate, anhydrite
11	0+50 0+55	Xenolith/pendant	Chlorite, sericite	Pyrite, pyrrhotite, ilmenite, sphalerite, chalcopyrite	Disseminated, veinlets, blebs	Anhydrite
11A	"	Xenolith/pendant	Amphibole, chlorite, epidote, quartz	Pyrite, sphalerite, pyrrhotite, ilmenite, leucoxene, chalcopyrite	Veinlets, blebs disseminations	Sulphides, quartz, anhydrite, gypsum
12	0+55 0+60	Hornblende diorite	Sericite, quartz, chlorite, epidote	(Opaques)	--	Quartz, anhydrite, carbonate
13	0+60 0+65	Hornblende diorite	Pyroxene, sericite	(Opaques)	--	Carbonate, quartz,
13A	0+60 0+65	Composite vein, (cataclastic) Hornblende diorite wallrock	--	(Opaques)	--	Anhydrite, quartz, carbonate
14	0+65 0+70	Hornblende diorite and inclusions	Sericite, chlorite, amphibole (tramolite) serpentine	(Opaques)	--	Anhydrite, chlorite
14A	"	Hornblende diorite and inclusions	--	(Opaques)	Disseminated	--
15	0+70 0+75	Diorite	Sericite, amphibole, chlorite	(Opaques)	Disseminated	--
15A	"	Diorite	Sericite, chlorite	(Opaques)	Disseminated	Anhydrite, chlorite

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TABLE 1 (continued)
MacNEILS BROOK QUARRY, E16-12, ANALYSES

Sample 86-11-6C	Interval (Fig 2)	Lithology	Alteration	Mineralization	anhydrite Type	Veins
III	0+40 0+45	Iron-stained debris	Epidote, sericite	>10% opaques	Blebs, irregular zones, veinlets	--
IIIA	"	Iron-stained debris	Epidote, sericite	>10% Pyrite, pyrrhotite, sphalerite	Blebs, irregular zones, veinlets	--
IV	0+39 0+40	Hornfels	Chlorite, sericite, amphibole	Pyrite, pyrrhotite, sphalerite	Disseminated, blebs, veinlets	--
V	See Fig 2	Recrystallized limestone	carbonate, wollastonite, quartz, chlorite	(Opaques)	-- Carbonate	
VA	"	Recrystallized limestone	Chlorite (2 varieties), amphibole, sericite	Pyrite, pyrrhotite, sphalerite	Disseminated, blebs, veinlets	--

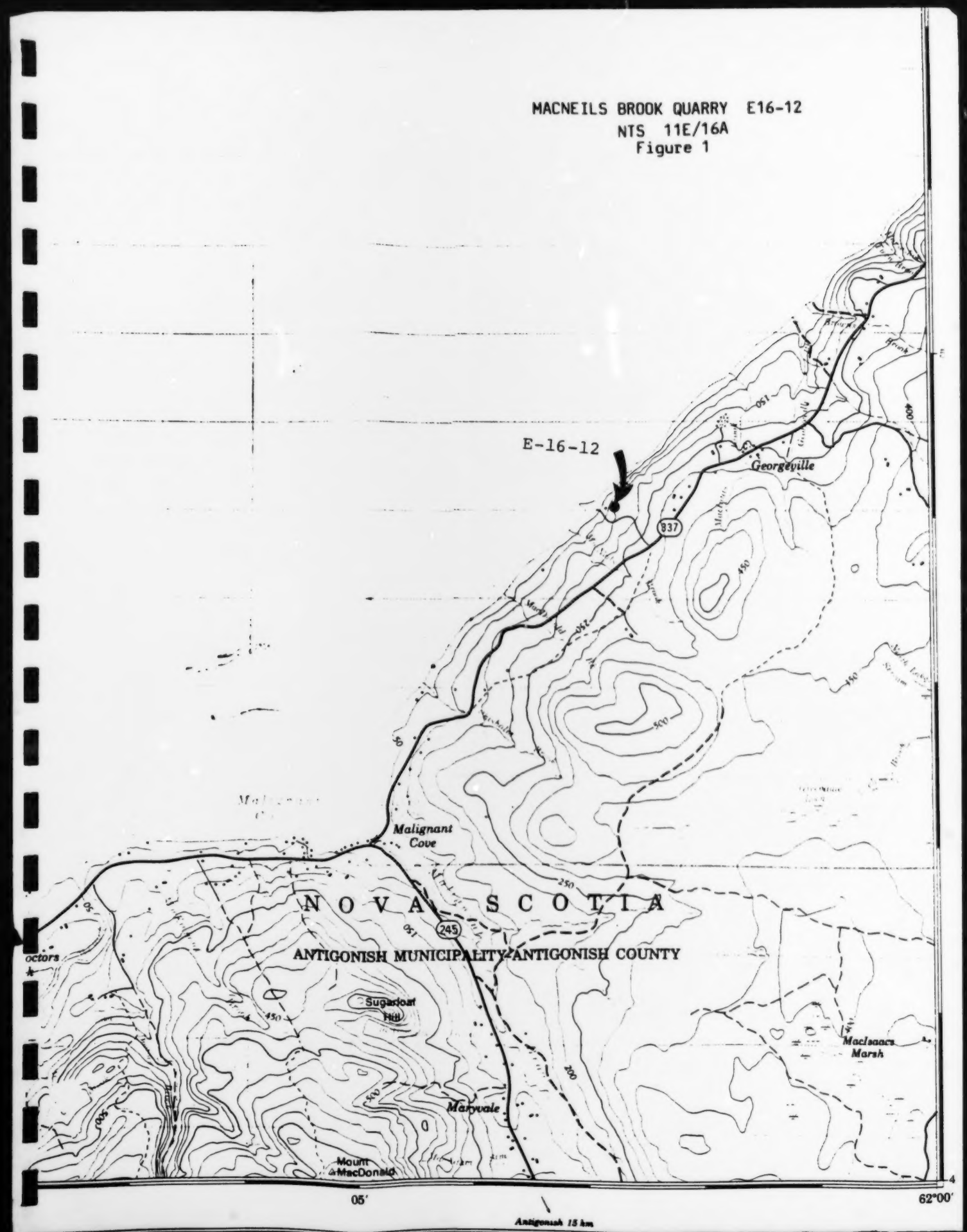
TABLE 2
MacNEILL BROOK QUARRY/GREENDALE COMPLEX ANALYSES

MacNEILL BROOK QUARRY/GREENDALE COMPLEX SILICATE ANALYSES

MacNEILL BROOK QUARRY/GREENDALE COMPLEX ADDITIONAL ANALYSES AND RARE EARTHS

MacNEILL BROOK QUARRY/GREENDALE COMPLEX + 35

MacNEILL BROOK: X-RAY FLUORESCENCE

MacNEILL BROOK: ASSAYS

MACNEILS BROOK QUARRY E16-12
NTS 11E/16A
Figure 1